

AUSTRALIAN CUMACEA. No. 14¹
FURTHER NOTES ON THE GENUS *CYCLASPIS*

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Fig. 1-21.

THROUGH the kind offices of Dr. A. G. Nicholls, Mr. Keith Sheard, Mr. Gilbert Whitley, and other collectors, there is now available a large number of Cumacea from Western Australian waters, mostly taken with submarine light traps. Notes on the species of *Cyclaspis* represented in this material are included herein.

I am further indebted to Mr. I. S. R. Munro for additional Cumacea from Queensland.

These collections extend considerably the known distribution of some species of *Cyclaspis* and show that the adults from different localities may differ greatly in size (see *C. mollis* and *C. fulgida* herein).

Only three species of the genus were recorded previously from Western Australia, but the following may be listed now as occurring on our Indian Ocean coast:

<i>mjobergi</i> Zimmer	<i>sheardi</i> Hale
<i>supersculpta</i> Zimmer	<i>spilotes</i> Hale
<i>candida</i> Zimmer	<i>sublevis</i> sp. nov.
<i>mollis</i> Hale	<i>juxta</i> sp. nov.
<i>fulgida</i> Hale	<i>strumosa</i> sp. nov.
<i>pura</i> Hale	<i>rudis</i> sp. nov.
<i>nitida</i> Hale	<i>brevipes</i> sp. nov.
<i>cretata</i> Hale	

Additional data are given also for *exsculpta* Sars, *cana* Hale, *caprella* Hale, and *globosa* Hale.

One of the new forms—*sublevis*—belongs to the *levis* group and would be placed close to *levis* itself in my key (Hale, 1944, p. 71). Another, *strumosa*, is allied to the New Zealand *coelebs* Calman and is of interest in that the distal setal furniture of the carpus of the posterior peraeopods is unusually feeble and because in the first peraeopod the merus is longer than the carpus.

In the light of further material it is now considered that *mjobergi* Zimmer and *sheardi* Hale, together with *rudis* and *brevipes* spp. nov. would be better

¹ For No. 13 see *Trans. Roy. Soc., S. Aust.*, lxx, 1946, pp. 178-188, fig. 1-4.

placed alongside *munda* and *pruinosa* in Section 2 of the key, all having the sides of the carapace with at least one tumidity below the pseudorostral suture, no depressed quadrilateral area on the side of carapace in at least the male, and no lateral elevations on the posterior part of carapace. The species concerned are separable thus; it should be noted that the adult female is known only in *sheardi* and (probably) *mjobergi*, and that the key does not necessarily apply to that sex.

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|----|---|----|----|----|----|----|--------------------------|---|
| 1. | Ocular lobe not longer than wide | .. | .. | .. | .. | .. | .. | 2 |
| | Ocular lobe much longer than wide | .. | .. | .. | .. | .. | .. | 5 |
| 2. | No dorsal pits at rear end of carapace | .. | .. | .. | .. | .. | <i>pruinosa</i> Hale | 3 |
| | A dorsal pit on each side of midline at rear end of carapace | .. | .. | .. | .. | .. | .. | 3 |
| 3. | Carapace with very feeble horizontal dorso-lateral ridges. Peduncle of uropod longer than rami | .. | .. | .. | .. | .. | <i>sheardi</i> Hale | 4 |
| | Carapace with well-developed horizontal dorso-lateral carinae. Peduncle of uropod not longer than rami | .. | .. | .. | .. | .. | .. | 4 |
| 4. | Peduncle of uropod two-thirds as long as rami. Dorsum of carapace corrugated | .. | .. | .. | .. | .. | <i>rudis</i> sp. nov. | |
| | Peduncle of uropod equal in length to rami. Dorsum of carapace not corrugated | .. | .. | .. | .. | .. | <i>brevipes</i> sp. nov. | |
| 5. | Carapace with two confluent antero-lateral tumidities below each pseudorostral suture. Three distal carpal setae on third to fifth peraeopods | .. | .. | .. | .. | .. | <i>munda</i> Hale | |
| | Carapace with one low swelling below each pseudorostral suture. Four distal carpal setae on third to fifth peraeopods | .. | .. | .. | .. | .. | <i>mjobergi</i> Zimmer | |

CYCLASPIS CAPRELLA Hale.

Cyclaspis caprella Hale, 1936, p. 395, fig. 1-2, and 1944, p. 74.

The adult female was previously unknown. As with some other Australian representatives of the genus, adult males often occur abundantly in hauls made with submarine light or townet. However, a mass of specimens of the species, taken recently by Mr. W. S. Fairbridge at Kettering, Tasmania, 2-3 fath. with a submarine light, consists largely of adult males and ovigerous females, the latter though outnumbered by the males being quite abundant. The Tasmanian locality extends the known distribution of the species.

Ovigerous female. Integument calcified, but thin and delicate with very fine reticulate patterning.

Carapace less than one-third of total length of animal considerably widened posteriorly, where it is slightly broader than deep and two-thirds as broad as long; the median dorsal carina is sharp on anterior two-thirds, less marked and rugose posteriorly. Anterior horn immediately below the tiny antennal angle on each side as in male and antennal notch shallow, widely open. Ocular lobe narrow (about three times as long as wide) one-seventh of length of carapace and

with the darkly pigmented eye confined to anterior third. Pseudorostral lobes not produced in front of ocular lobe.

Pedigerous somites together little more than half as long as carapace; the first is exposed but dorsally it is very short; second strongly elevated dorsally, its peak rising above level of dorsum of carapace, resulting in a U-shaped or V-shaped space between it and carapace when viewed from side, the dorsum of

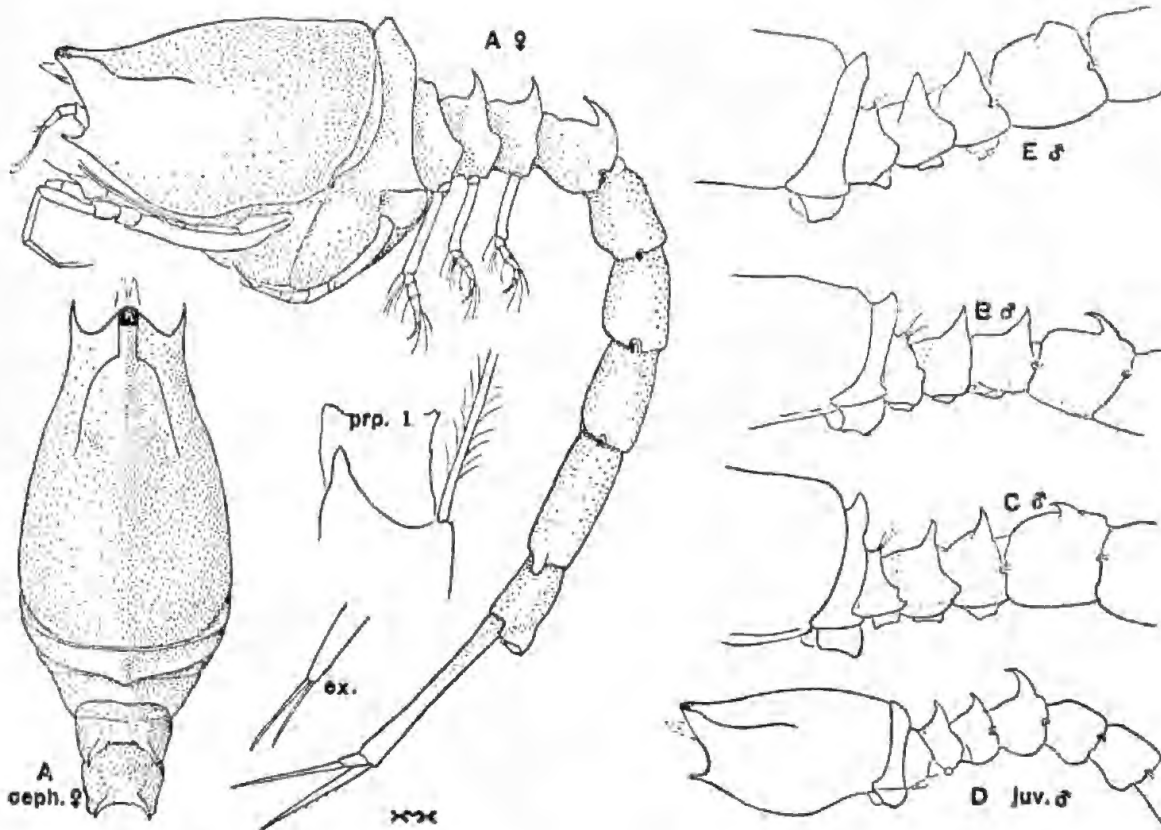


Fig. 1. *Cyclaspis caprella*. Ovigerous female; lateral view and (ceph.) cephalothorax from above ($\times 23$); prp., distal end of basis of first peraeopod ($\times 150$); ex., tip of exopod of uropod ($\times 300$). B and C, Pedigerous somites and first pleon somite of adult males, and (D) cephalothorax of young male, from Tasmania ($\times 23$). E, Pedigerous somites and first pleon somite of type male ($\times 23$).

first somite forming the narrow bottom of the gap; third somite not elevated dorsally; fourth and fifth each with a pair of triangular teeth on dorsum.

Pleon longer than cephalothorax; somites, like pedigerous somites, without distinct median dorsal carina except on posterior half of fifth somite where even then it is not at all prominent; first somite with a strong procurved tooth on each side of back, near posterior end.

First joint of peduncle of first antenna as long as combined lengths of second and third segments; second about four-fifths as long as third; flagellum almost as

long as the third peduncular segment and with the first of its two joints fully half as long again as second.

Basis of third maxilliped fully half as long again as remaining joints together.

First peraeopod not very long, the carpus of extended limb reaching barely beyond level of front of carapace; basis shorter than rest of limb, with apex produced on inner (or ventral) side to form a small triangular tooth such as occurs in some other species of the genus (see fig. 1, prp. 1); carpus subequal in length to propodus and nearly half as long again as dactylus.

Second peraeopod with basis a little longer than rest of limb; ischium distinct; dactylus longer than merus, not much shorter than carpus and propodus together, and with longest terminal spine longer than the joint. Posterior legs as in male.

Peduncle of uropod nearly twice as long as telsonic somite, one-fourth as long again as the subequal rami, and without setae, etc., such as are developed in male; exopod with two terminal mucrones (fig. 1, ex.).

Ground colour whitish; carapace and pedigerous somites with stellate dark brown spots; pleon somites also spotted, the chromatophores sometimes arranged to form a band across each.

Length 5 mm.

Males. As in the female the shape of the elevated dorsum of the second pedigerous somite is a little variable in the adult male (cf. fig. 1, A-C). The dorsal elevations of the first pleon somite of mature examples also show differences; in most of the Tasmanian specimens they are developed as a pair of procurved teeth (fig. 1, B), much as in the female, but sometimes they are not nearly so long (fig. 1, C); the extreme in reduction is found in the type, where they are obtuse, triangular, and not at all tooth or hook-like (fig. 1, E). There is also variation in the size of the distal tooth of the basis of the first peraeopod.

Young males have the dorsal teeth of the first pleon somite much more pronounced than in the adult; the second pedigerous somite fits intimately against the posterior margin of the carapace, and although dorsally it is raised a very little above the latter, its anterior face does not slope back on the dorsum as in mature examples. The cephalothorax of a juvenile male 3.5 mm. in length, is shown at fig. 1, D.

CYCLASPIS CRETATA Hale.

Cyclaspis cretata Hale, 1944, p. 91, fig. 19-20.

The typical form proves to have a wide distribution in Australia, ranging from lat. 24° to 34° on the eastern coast and between lat. 21° and 33° off Western Australia; a large number of examples, mostly males, are available.

Examples from Queensland and from the western coast of Australia are all a little smaller than the New South Wales type, the adult males being from

4.5 mm. to 5.5 mm. in length, the ovigerous females 4 mm. to 5 mm. The uropods of these smaller males are as in the New South Wales type series, but in the adult females some difference in the armature of these appendages is to be noted. In the type subadult female the uropods are unusual in that the endopod has the spines of the inner margin as in the male. Other New South Wales females have no slender spines near proximal end of this ramus and at most fifteen short spines on the inner margin. The smaller, adult females from Queensland and Western Australia have only from ten to twelve inner spines on the endopod.

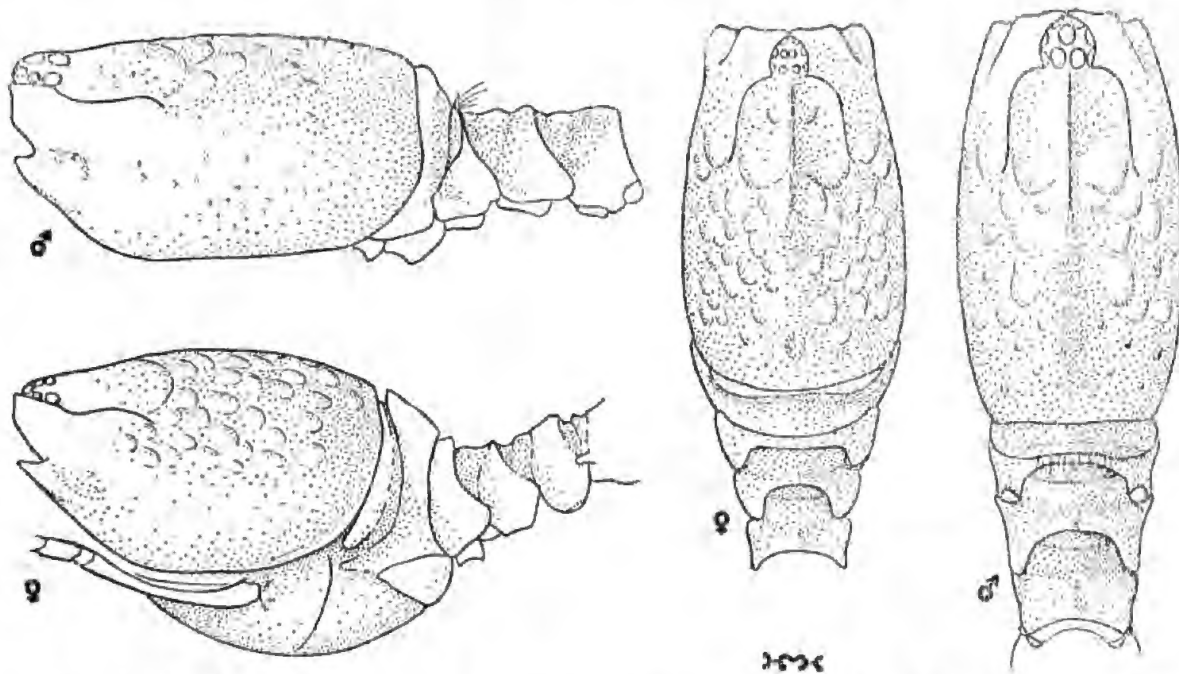


Fig. 2. *Cyclaspis cretata*; cephalothorax of adult male and ovigerous female, from the side and from above ($\times 30$).

In all examples, both male and female, and from all localities, at least the distal third of the endopod of the uropod is unarmed (see fig. 4 A, and Hale, 1944, fig. 20 D).

In the original description of *cretata* some faint indentations posterior to the large anterior dorso-lateral depressions of the carapace were noted. In some examples, particularly amongst Queensland material, these indentations are developed as prominent shallow pits, while in others from the same localities the surface of the carapace is smooth except for the usual minute reticulate patterning. Variation of the superficial patterning is noted elsewhere (see *C. juxta* herein, *Gynodiastylis ornata* Hale, 1946, p. 404, fig. 33-34, etc.); it seems also that sculpture of greater significance, in that it is indicative of a group within the genus, may vary in degree of definition in one species, as is noted herein for *C. candida* and *mjobergi*.

C. strigilis Hale (1944, p. 83, fig. 11-14) is very like *cretata*; apart from the minute sculpture of the carapace it differs only in having the rami of the uropod distinctly longer than the peduncle in both sexes. In *cretata* the rami are barely longer than peduncle (adult male) or equal to it in length (ovigerous female).

C. cretata closely resembles *herdmani* Calman also, but the last-named species differs in that the first peraeopods have the propodus, carpus and dactylus equal in length (Calman, 1904, p. 171, and 1907, p. 6).

The first peraeon somite is partly exposed in the ovigerous female of *cretata* (fig. 2) but is wholly concealed in the male and subadult female. The following additional localities may be recorded for the species:

Loc. Queensland: off Moreton Island ("Warreen" Station, submarine light, May, 1936); off Sandy Cape, 25-0 metres ("Warreen" Station, July, 1939); Moreton Bay (I. S. R. Munro, Towner, November, 1940); Noosa River (I.S.R. Munro, March, 1944). Western Australia: Shark Bay, South Passage, 1½ fath., on sand (G. P. Whitley, ex cutter "Isobel," submarine light, November, 1945); Rottnest Island, Thomson Bay (J. Clarke and R. Kenny, submarine light, November, 1945); Abrolhos Islands, Turtle Bay, east Wallabi Island, 2 fath., sandy bottom near coral reefs (G. P. Whitley, ex cutter "Isobel," submarine light, December, 1945).

CYCLASPIS JUXTA sp. nov.

Adult male. Integument calcified thin and brittle; surface of carapace finely reticulate and roughened by a somewhat vermiculate sculpture.

Carapace of same proportions as in *C. cretata* (Hale, 1944, p. 92) but with dorsal outline, as seen from side, slightly irregular because of the minute projections referred to; dorsum medianly carinate and with a shallow dorso-lateral depression on each side in anterior third; antennal notch and tooth, ocular lobe and pseudorostral lobes as in *cretata*.

Second (first free) peraeon somite with dorsal edge, as seen from the side, sloping very obliquely backwards, its anterior margin in the middle a little elevated; each somite with low median carina.

Pleon somites each with a median ridge; telsonic somite with strong dorsal notch.

Antennae and peraeopods very similar to those of *cretata*. The carpus of the first peraeopod reaches a little beyond level of antennal tooth; the basis has, similarly, a distinct inner apical tooth but is longer, being one-third as long again as combined lengths of remaining joints; propodus a little longer than carpus and half as long again as dactylus.

Peduncle of uropod with plumose setae on whole length of inner margin and a second series of slender serrate spines on distal fourth of this margin; it is two-thirds as long again as telsonic somite and is one-fourth as long again as exopod, which is a little longer than endopod and bears about half a dozen plumose setae on proximal half of inner margin; the inner margin of the endopod with nine slender serrate spines in proximal third of length, followed by nine shorter and stouter spines, leaving the distal fourth of the ramus unarmed.

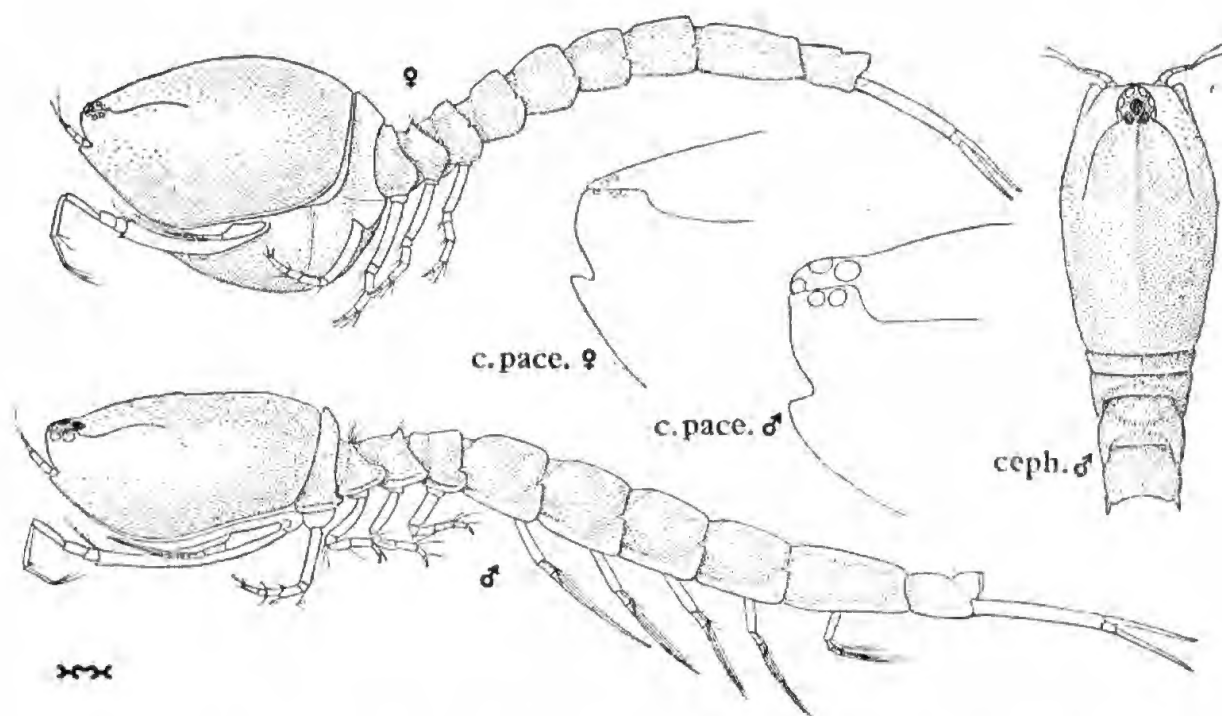


Fig. 3. *Cyclopsis juxta*, types adult female and male; lateral views and (ceph.) cephalothorax from above ($\times 18$; c.pace., frontal portion of carapace from the side, $\times 42$).

Colour semi-transparent, whitish with faint brown mottlings, leaving the inferior portions of last-named pale.

Length 5.2 mm.

Female. Four females are available. These have the integument scarcely at all calcified, evidently as a result of recent ecdysis; the fully developed marsupium is empty but the yellow egg-mass contains large ova (see also Hale, 1944, p. 124, and 1944a, p. 273).

The dorsum of the carapace, as seen from the side, is much more strongly arched than in the male and the ocular lobe is considerably less prominent, with much smaller lenses. The carapace is slightly more than one-third of the total length of the animal and is decidedly more than half as deep as long.

Pedigerous somites together one-half as long as carapace; the first is exposed as a narrow strip; the second slopes back very obliquely on dorsum and is there longer than in male.

Pleon exhibiting the usual sexual differences; it is subequal in length to carapace and pedigerous somites together (one-fourth as long again in male).

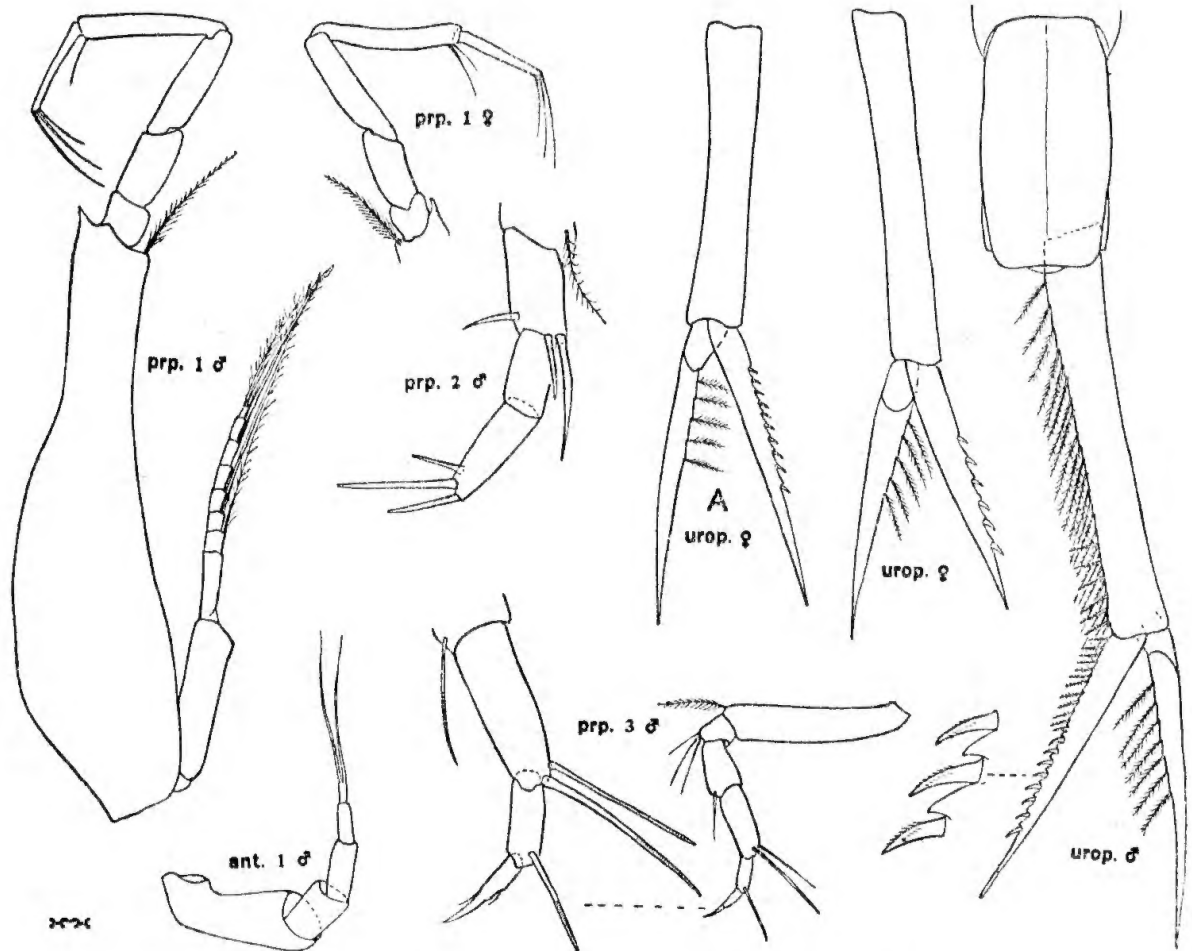


Fig. 4. *Cycloaspis juxta*, paratypes adult male and female; ant. 1, first antenna ($\times 80$); prp. 1, first pereopod of male and (distal joints only) female ($\times 56$); prp. 2, distal joints of second pereopod ($\times 126$); prp. 3, third pereopod ($\times 56$; distal joints, $\times 126$); urop., uropod, etc. ($\times 56$). A, urop., Uropod of ovigerous female of *C. cretata* for comparison ($\times 56$).

First pereopod with basis equal in length to rest of limb; propodus three-fourths as long again as dactylus and a little longer than carpus.

Peduncle of uropod nearly half as long again as telsonic somite and one-fourth as long again as exopod; endopod slightly shorter than exopod, its inner margin with six stout spines but no slender spines near proximal end; the distal fourth of the ramus is without spines.

Length 4.4 mm.

Loc. Western Australia: Off Rottneest Island, hauls 22, 24, 26, 27 and 28 (type loc., J. Clarke and R. Kenny, November, 1945); Garden Island (A. G. Nicholls, November, 1946). Types in South Australian Museum, Reg. No. C. 2991-2992.

The carapace exhibits a granulose or vermiculate patterning as a rule, but the sculpture may be evanescent.

Males vary a little in length, the largest attaining to 5.5 mm. The anterior portion of the dorsum of the first free pereopod somite of this sex (as seen from the side) is raised a trifle above the level of the posterior margin of the carapace, so that a minute V, wide or narrow, is left between.

The species is closely allied to *cretata* and might have been regarded as a variant were it not for the fact that three hundred males are readily separated from a large number of examples of the last-named by the character of the uropods. In these appendages the rami are relatively shorter in *juxta*. The peduncle is not or barely longer than the exopod in *cretata*, whereas in the male of *juxta* it is one-fourth or more as long again as this ramus, and in the female it is at least one-fifth as long again. The endopod is furnished with fewer inner spines, which in the female, and on the distal half of the ramus in the male, are larger, while much less than the distal third of the endopod is unarmed (see fig. 4, urop. ♀ and cf. fig. 4, urop. ♂ with Hale, 1944, fig. 20 D). Further, in the male of *juxta* the slender spines on proximal part of inner edge of the endopod are more numerous; there are here nine or ten serrate spines followed by seven to eleven shorter and stouter spines. In the ovigerous female of *juxta* the endopod, as noted above, has half a dozen inner spines instead of at least ten as in *cretata*.

CYCLASPIS PURA Hale.

Cyclaspis pura Hale, 1936a, p. 405, fig. 1-2; 1937, p. 61; 1944, p. 106, fig. 31-32.

Nearly three thousand examples of this species were taken by Dr. A. G. Nicholls and students from Careening Bay, Garden Island, Western Australia, during the night of November 26-27, 1946, with submarine light trap. Approximately 90 p.c. are adult males between 4 mm. and 4.5 mm. in length; these have the peduncle of the uropod approximately half as long again as the rami, a feature obtaining in larger examples previously described from South Australia (Hale, 1944, p. 109); only six ovigerous females are present in the catches from Garden Island.

C. pura was known previously only from South Australia.

Mr. Keith Sheard recently sent for examination a specimen collected by him during the 1939 "Warreén" investigations. This was secured by townet at the surface, March, 1939, at 4 a.m., 40 to 50 miles offshore in Lacepede Bay, South

Australia (lat. $36^{\circ} 35' S.$; long. $138^{\circ} 50' E.$); the depth of water at this spot was 40 fathoms. This example is considerably larger (7.8 mm. in length) than any of the inshore material which has been described; the pereopods are as in the larger littoral males (Hale, 1944, p. 109), but the carpal and propodal setae of the fossorial legs are longer, while the uropod has the peduncle relatively a little more elongate, it being more than half as long again as the rami.

CYCLASPIS NITIDA Hale.

Cyclaspis nitida Hale, 1944, p. 109, fig. 33-34.

A large number of males taken in November, 1945, by J. Clarke and R. Kemy off Rottnest Island, Western Australia (lat. $32^{\circ} S.$), are 4 mm. in length and in other respects agree closely with the type material from the east coast of Australia in lat. $34^{\circ} S.$ Other males were captured at Esperance Bay (January, 1945) and also at Garden Island (November, 1946), Western Australia, by Dr. A. G. Nicholls, both localities lying between the latitudes mentioned.

This species has not been taken off southern Australia.

CYCLASPIS SUBLEVIS sp. nov.

Adult male. Integument not calcified, thin and almost membranous.

Carapace with dorsal margin slightly and evenly curved except for the tumid eye-lobe; it is not much more than one-fourth of total length of animal, is as wide as deep and is nearly twice as long as deep; seen from above the sides are evenly curved and the carapace is not noticeably narrowed towards the front; the dorsum is rounded from side to side and has only very feeble indication of a median longitudinal carina; antennal notch very widely open and antennal tooth subacute; pseudorostral lobes with anterior margin somewhat obliquely truncate, both as seen from above and from the side, just meeting in front of ocular lobe, which is as wide as long and has distinct corneal lenses.

The four exposed pedigerous somites together are more than half as long as carapace; all are smooth or almost so.

Pleon robust and very long, fully one-third as long again as cephalothorax; it has an indistinct median longitudinal carina on dorsum and the usual articular pegs are present, but are very small; first to fourth and telsonic somites subequal in length, fifth nearly one-third as long again; telsonic somite narrow, twice as long as wide, only slightly dilated towards distal end, which is produced over bases of uropods.

First antenna with basal joint of peduncle almost as long as combined lengths of second and third joints; third barely shorter than second and longer than the

two-jointed flagellum. Second antenna with flagellum reaching to middle of length of peduncle of uropod.

First peraeopod with carpus reaching to level of antennal tooth; basis more than one-third as long again as rest of limb and with a strong inner tooth at distal end as well as the usual plumose seta at external distal angle; carpus shorter than propodus and one-third as long again as dactylus.

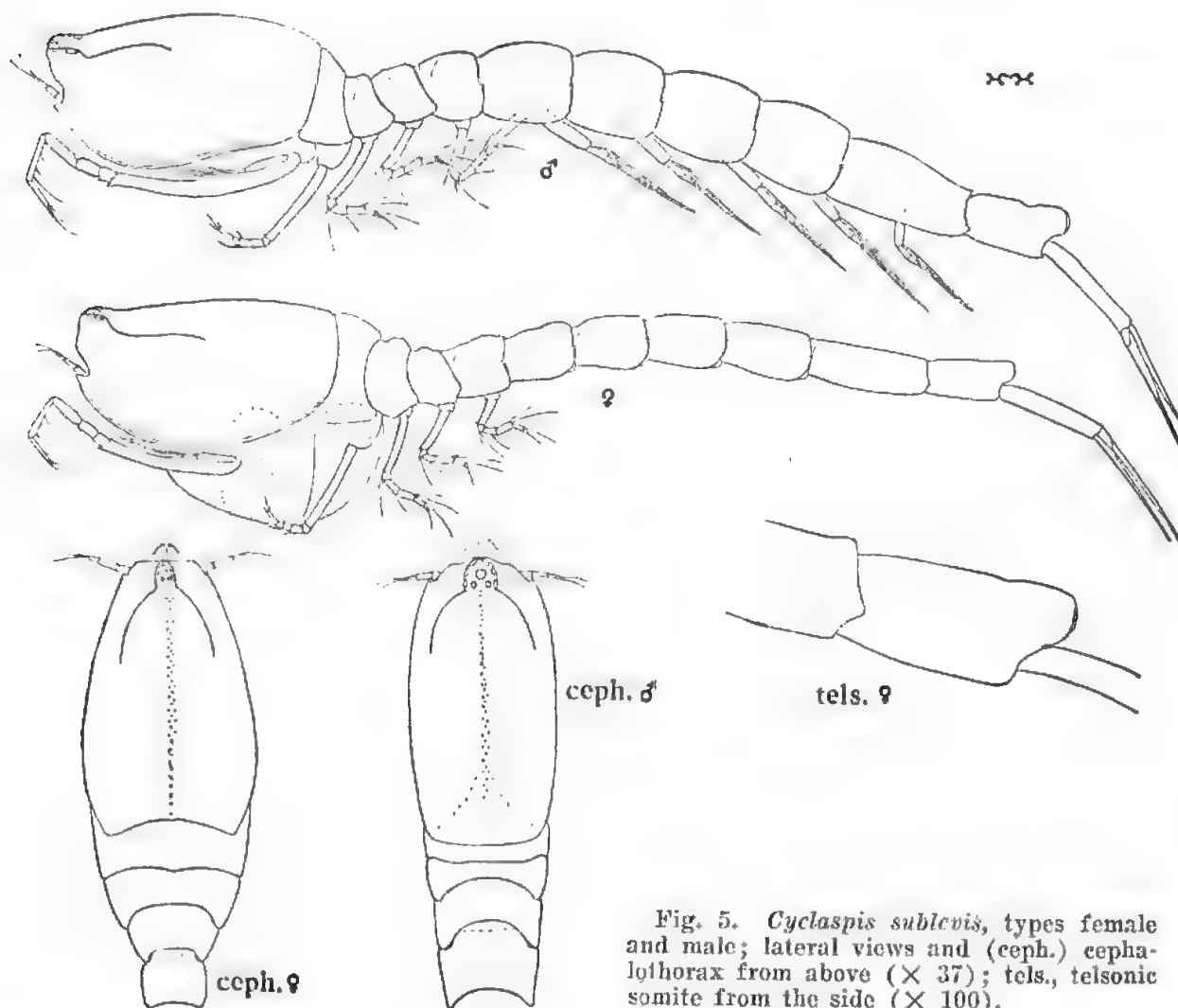


Fig. 5. *Cyclopsis sublevis*, types female and male; lateral views and (ceph.) cephalothorax from above ($\times 37$); tels., telsonic somite from the side ($\times 100$).

Basis of second peraeopod elongate, two-thirds as long again as combined lengths of remaining joints; ischium distinct; merus more than half as long again as carpus, which is armed with a long, outer distal spine, reaching beyond middle of length of dactylus, and a shorter spine on inner margin; dactylus three-fourths as long again as propodus, with the longest of its three distal spines fully as long as the joint; the two others are subequal in length and are two-thirds as long as the longest spine.

Third to fifth peraeopods slender, with the basis not quite as long as rest of limb; carpus half as long again as propodus and with two distal setae, the longer, like that of propodus reaching well beyond tip of dactylus; the latter is unusual in that its distal portion, for fully two-thirds of its length, is bristle-like (see fig. 6, prp. 3, dactylus).

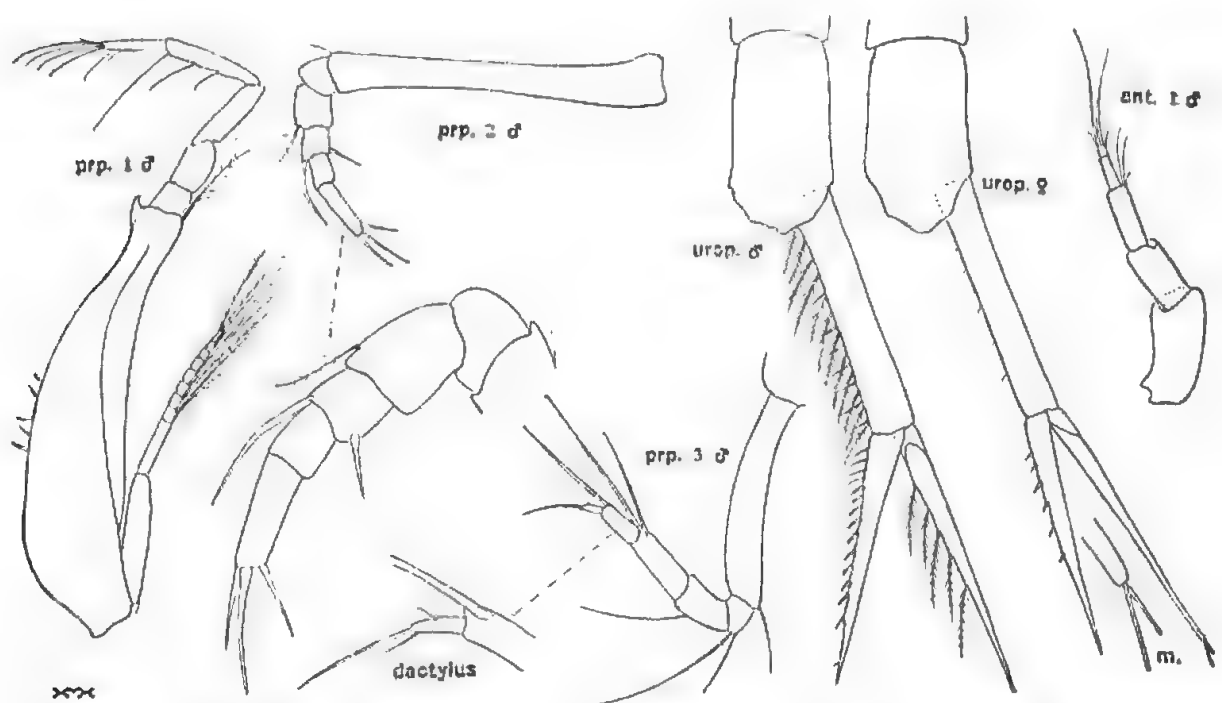


Fig. 6. *Cyclops sublevis*, types female and male; ant. 1, first antenna ($\times 126$); prp. 1, first peraeopod ($\times 74$); prp. 2-3, second and third peraeopods ($\times 116$; dactylus, $\times 250$); urop., uropod and telsonic somite ($\times 74$; m, mucrones of exopod, $\times 250$).

Peduncle of uropod one-fourth as long again as telsonic somite and equal in length to the endopod, its inner margin for the whole length furnished with plumose setae, below which, in posterior two-thirds, is a second series of shorter setae; exopod slender, about one-tenth as long again as endopod, with five plumose setae on inner margin and with a pair of mucrones at apex; inner margin of endopod with four slender spines near proximal end, followed by a series of ten shorter and stouter spines, and with a tiny spine not far from the simple and acute distal end.

Colour: transparent, except for a few scattered chromatophores.

Length 3 mm.

Ovigerous female. Carapace dilated in posterior half, where it is distinctly wider than greatest depth; it is two-sevenths of total length of animal. Ocular lobe smaller and relatively narrower than in male, and antennal notch less widely open.

Only four pedigerous somites exposed; together they are almost two-thirds as long as carapace.

Pleon slender but only one-fifth as long again as cephalothorax; the articular pegs are so minute that they are difficult to detect; telsonic somite much as in male.

Peraeopods much as in male but basis in first pair relatively shorter, being equal in length to rest of limb.

Peduncle of uropod one-fourth as long again as telsonic somite and equal in length to endopod; exopod a little longer than endopod, and with two elongate unequal mucrones at distal end (fig. 6, urop., m.); endopod with only half a dozen small spines on inner margin, the distal third unarmed and tapering to an acute apex.

Colour as in male.

Length 2.8 mm.

Loc. Western Australia: Broome, 3½ fath., on sandy mud (type loc.) and Vlaming Head, North-West Cape, 2 fath., sandy bottom (G. P. Whitley, ex cutter "Isobel," submarine light, September and November, 1945, surface temperatures 24.10° and 24.93° C.). Types in South Australian Museum, Reg. No. C. 2997-2998.

This species belongs to the *levis* group and in the writer's key (Hale, 1944, p. 71) would fall in Section 1, between 27 and 29. Of the species there included, it apparently most resembles the much larger New Zealand *calmani* Hale (= *levis* Calman *nec* Thomson), but in the last-named the basis of the first peraeopod has no distal tooth and the rami of the uropod are relatively not as long, the exopod being considerably shorter than the peduncle; Calman (1907, p. 8, pl. v, fig. 6-8) does not describe the posterior peraeopods and doubtless these also will exhibit differences.

The long and slender dactylus of the third to fifth peraeopods serves to at once separate *sublevis* from the other four species of the abovementioned group. Of these, only *coltoni* Hale has similar setal armature on the posterior peraeopods, but the uropods are distinctive.

CYCLASPIS STRUMOSA sp. nov.

Adult male. Integument calcified and brittle. Carapace with the surface reticulate patterning relatively coarse.

Carapace less than one-third of total length of animal, as wide as long and three-fourths as long again as deep; about midway along the length of each side the carapace is slightly swollen and there is a low tumidity below the posterior half of each pseudorostral suture; viewed from above the sides are sinuate, partly because of the large lateral swellings and partly owing to the fact that the area below the antennal notch flares outwards, the outer limit of the expanded portion

defined by a carina running back from the antennal tooth; there is no distinct longitudinal carina on the back of the carapace; the mid-line is angularly rounded and in anterior half of carapace is elevated to form a series of low tubercles, so that seen from the side the front portion of the dorsum presents a slightly corrugated appearance. Pseudorostrum widely truncate, the lobes barely meeting in front of ocular lobe. Antennal notch moderately open and antennal tooth subacutely rounded. Ocular lobe broad, as wide as long, with large and prominent corneal lenses; frontal lobe with the pair of pits so often present.

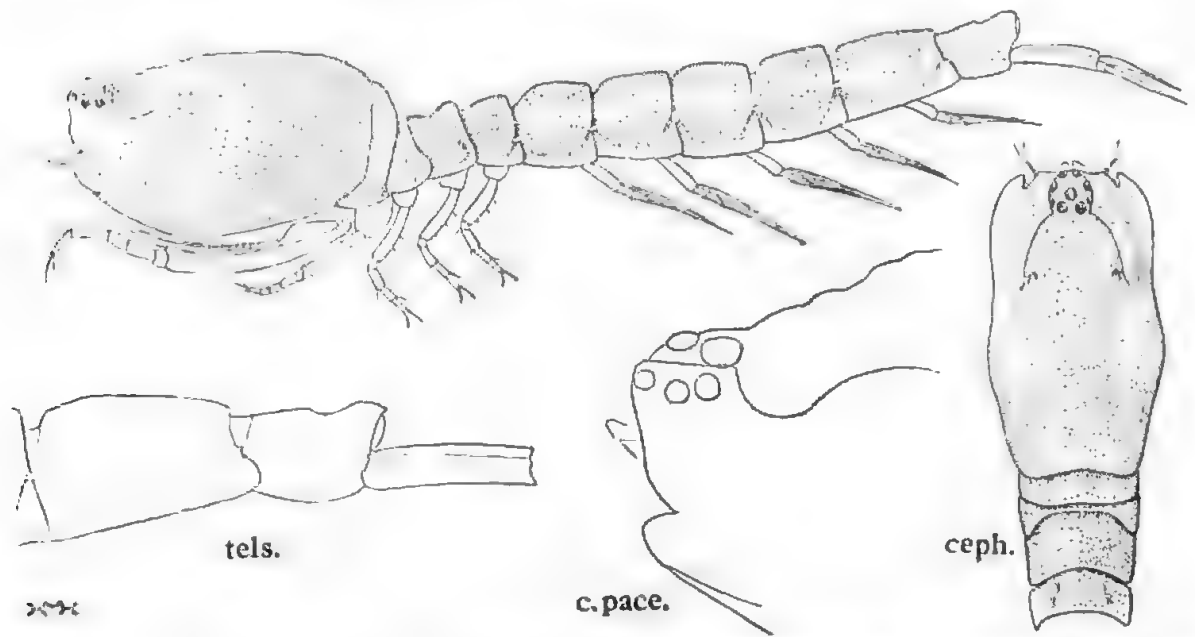


Fig. 7. *Cyclaspis strumosa*, type male; lateral view and (ceph.) cephalothorax from above ($\times 21$); c.pace., anterior portion of carapace ($\times 40$); tels., peduncle of uropod with fifth pleon and telsonic somites, from the side ($\times 40$).

Four pedigerous somites exposed; together they are half as long as carapace; the dorsum of the second slopes backwards very obliquely and the lateral areas of the third to fifth are moderately prominent; the back is smooth except for a feeble dorso-lateral carina on each side of fifth, all somites lacking a median longitudinal carina.

Pleon only one-seventh longer than cephalothorax; first to fourth somites swollen on sides, rounded on back but without ridge on mid-line; fifth somite tapering to rear with sides sinuate; it is widest near the base and has a distinct median longitudinal dorsal carina in posterior half; telsonic somite about three-fourths as long as fifth pleon somite; it is narrow, being nearly twice as long as greatest width, which occurs near distal end, and has a dorsal carina on mid-line of proximal half; the dorsal notch is shallow.

Second antenna with flagellum reaching beyond end of pleon,

First pereopod with distal portion short, the propodus of the extended limb not quite reaching level of antennal tooth; basis two-thirds as long again as combined lengths of remaining joints, without distal tooth but with the usual external apical seta; carpus a little shorter than merus, five-sixths as long as propodus and barely shorter than dactylus, which has one of the setae of distal end long and stout.

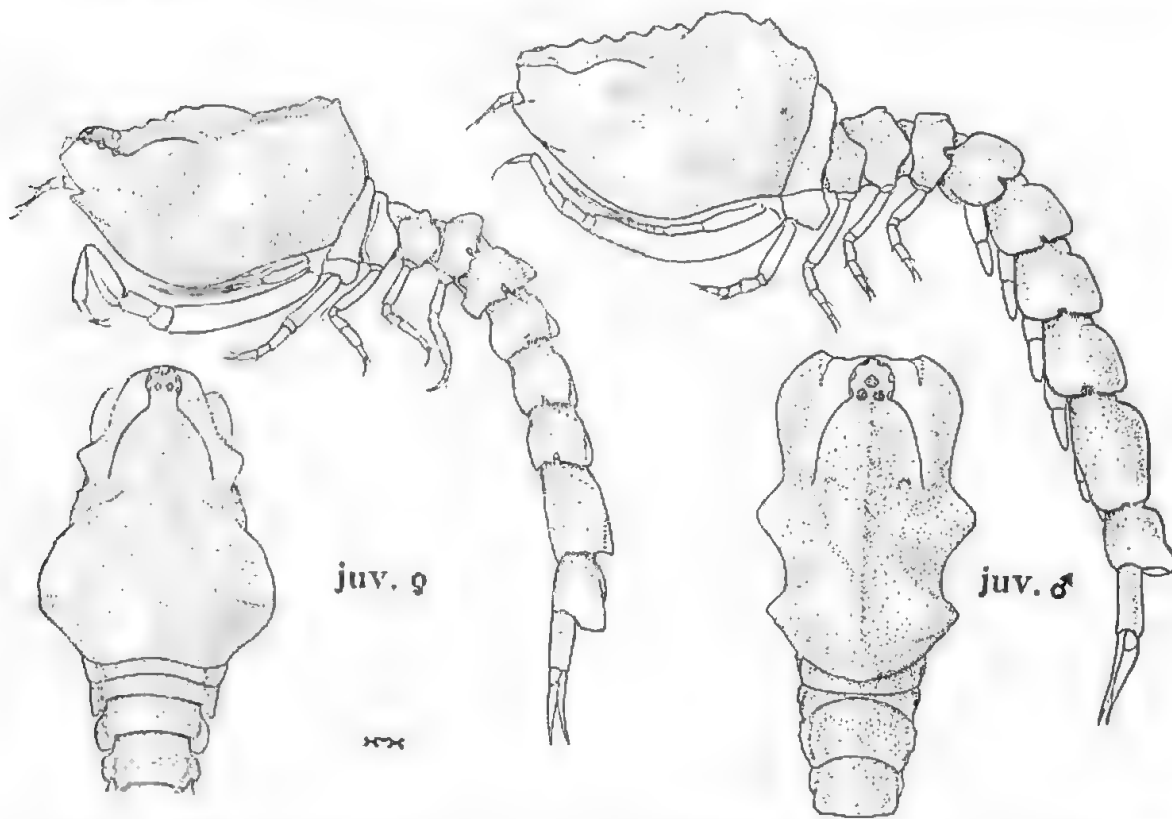


Fig. 8. *Cyclopsis strumosa*, lateral views and cephalothorax from above of subadult male ($\times 15$) and young female ($\times 19$).

Basis of second pereopod fully as long as rest of limb; dactylus nearly half as long again as propodus and distinctly shorter than either merus or carpus, which are subequal in length; the longest distal dactylar spine is almost as long as combined lengths of dactylus and propodus, while the other two are short and subequal.

Basis of third pereopod longer than rest of limb; that of fourth and fifth about equal in length to remaining joints together; carpus of posterior legs barely longer than propodus; setal armature very unusual in that the carpus bears only a single distal outer seta, which is very short (not reaching beyond the distal end of propodus) and is much more slender than the propodal seta; the last-named is stout and reaches almost to tip of dactylus, which is slender and is equal in length to propodus.

Uropod with peduncle barely longer than telsonic somite, equal in length to exopod and with two series of setae on the distal half of the serrate inner margin; exopod subequal in length to endopod and with eight plumose setae on inner margin; endopod with both margins serrate, its inner edge with ten slender spines in proximal half, followed by two stouter and shorter spines.

Colour yellow, closely spotted all over with minute, brown chromaophores.

Length 5 mm.

Loc. Western Australia: Off Onslow, Airlie Island, 3 fath., on rock, coral and sand (G. P. Whitley, submarine light, ex cutter "Isobel," 7-40 p.m. to 8 p.m., September, 1945, surface temperature 21.6° C.). Type in South Australian Museum, Reg. No. C. 3012.

The salient features of the adult are found in the proportions of the joints of the first peraeopod, where the merus is *longer* than the carpus, in the setal furniture of the third to fifth peraeopods and the tumidities of the carapace. In the key to the species (Hale, 1944, p. 71) *strumosa* would fall near the New Zealand *coelebs* (described from the adult male only, see Calman, 1917, p. 150, fig. 5). Calman's figure shows a single short carpal seta on the posterior peraeopods and his species in some other respects shows affinities but is at once separated by the very different proportions of the limb joints, while the exopod of the uropod has an apical spine. In *coelebs* the sides of the carapace have in the posterior half a faint curved carina, approximating to the hinder limits of the lateral tumidities of *strumosa*.

Two immature examples, a subadult male and a juvenile female, are described below as possibly co-specific with *strumosa*.

Subadult male. Seen from the side the dorsum of the carapace exhibits a corrugated outline, but posteriorly over the branchial regions it is much more elevated, there being a conical prominence on each side; below this tumidity and approximating to the postero-lateral tubercle on the second transverse ridge of the *exsculpta* group (Hale, 1944, fig. 2) there is another conical elevation, most evident in dorsal view. There is a deep hollow on each side—the quadrilateral area of the *exsculpta* group—emphasized above by a subconical elongate elevation below the frontal lobe and continued back as an ill-defined dorso-lateral fold, and below by a similar prominent protuberance, which, like the postero-lateral hump, materially affects the lateral contour when the animal is viewed from above (fig. 8). The antennal ridge is well defined, just as in the adult.

Carinae of pedigerous and pleon somites as in adult, but less conspicuous. Pleon only about one-tenth as long again as cephalothorax and exhibiting the differences usual in subadults of members of this sex in the genus.

Basis of third maxilliped not much more than half as long again as remaining joints together.

First peraeopod relatively shorter than in adult; basis fully half as long again as rest of limb; carpus a little shorter than merus, a little shorter than propodus and subequal in length to dactylus.

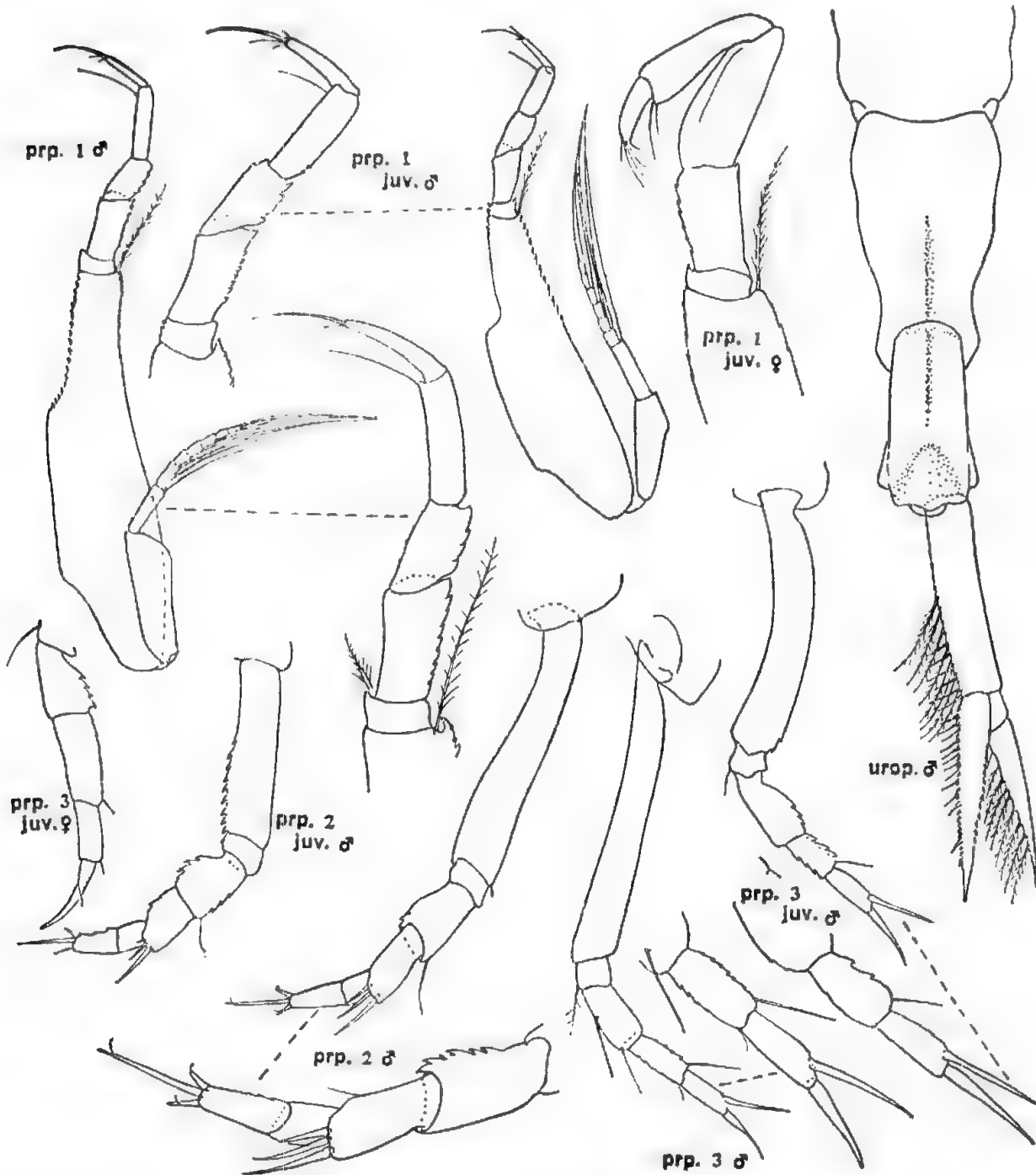


Fig. 9. *Cyclopsis strumosa*, paratype adult male, and young male and female; prp. 1, first peraeopod ($\times 50$; distal joints only, $\times 62$); prp. 2-4, second to fourth peraeopods ($\times 62$; distal joints only, $\times 160$); urop., uropod with fifth pleon and telsonic somites ($\times 50$).

Second peraeopod relatively shorter than in adult.

Third to fifth peraeopods with one short distal carpal seta and with propodal seta stout and reaching almost to level of tip of dactylus.

Peduncle of uropod little more than two-thirds as long as subequal rami.

Colour white, with faint brown spots on carapace.

Length 3.7 mm.

Loc. Western Australia: Off Garden Island (G. P. Whitley, submarine light, 6.50 p.m.–7.10 p.m., July, 1945). Reg. No. C. 2843.

Although it was taken far to the south of the type locality (lat. 21.5° S. and 17° S.), it is highly probable that this is a young male of *strumosa*. We find as important connecting characters the unusual proportions of the distal joints of the first peraeopod and the unusual setal armature of the third to fifth peraeopods. The elongation of the carapace of the adult male and the "smoothing out" of the sculpture is no more marked than in, for instance, *tribulis* (see Hale, 1944, p. 114).

It may be postulated that, as in some other members of the genus, the sculptured forms in particular, the young male resembles the female more closely than does the adult male. Acceptance of the subadult male described above as belonging to *strumosa* leads one also to place here, with far more hesitation, a juvenile female from Queensland (lat. 27.2° S.) which has somewhat similar sculpture.

Immature female. As in the young male described above the integument is well calcified, with fine reticulate patterning; parts of the carapace are faintly granulate.

Seen from above the conical tumidities below posterior part of frontal lobe (antero-lateral tubercles) project conspicuously, but the greatest width of the carapace occurs across the branchial regions, which flare upwards and outwards on each side and are crossed by a transverse carina which continues completely across the back, meeting, at widest point of latter, a ridge running forward to end of suture of frontal lobe, where there is a small tumidity; seen from the side the carapace is elevated dorsally at about middle of length, and both anterior and posterior to this are smaller tumidities, resulting in a very irregular dorsal outline; a well-defined ridge extends back from antennal angle for about one-fourth of length of carapace; the mid-line is roof-shaped in anterior two-thirds, is slightly depressed between the branchial regions (where to the rear it is marked by a fine impressed line) and is slightly elevated at the rear end. Ocular lobe wide; antennal notch and angle as in males described above.

Dorsal lengths of second (first exposed) and third pedigerous somites together equal to fourth; second to fifth each with a dorso-lateral swelling on each side, most apparent on last two somites.

Pleon about equal in length to cephalothorax; somites one to five, and anterior

part of telsonic somite, with median carina and with a dorso-lateral ridge on each side, the latter becoming less distinct on posterior somites.

First peraeopod with basis not longer than rest of limb; carpus and propodus subequal in length, each longer than ischium and merus together.

Dactylus of second peraeopod not much longer than propodus, but with shorter terminal spines more unequal than in adult male described above.

Carpus of posterior legs much shorter than propodus and dactylus together, and with one very short distal seta; propodal seta also not nearly reaching level of apex of dactylus (fig. 9, prp. 3, juv. ♀).

Peduncle of uropod about two-thirds as long as the subequal rami.

Colour white.

Length 2.7 mm.

Loc. Queensland: Off Moreton Island ("Warreen" Station, 6.30 p.m.—7.30 p.m., May, 1939). Reg. No. C. 2842.

Remarks. This young female is linked to the subadult male from Western Australia by the row of median dorsal tumidities behind the ocular lobe, the strong antennal ridge, wide eye-lobe, the character of the third maxilliped, etc. In general the sculpture is much as in the aforementioned male, but the appearance of the carapace as viewed from above is very different because (1) the lateral tumidity behind and below the antero-lateral tubercle is less elevated; (2) the prominences over the branchial regions are much more pronounced.

As mentioned already, the identification of the small female is open to doubt. The first peraeopod (fig. 9, prp. 1, juv. ♀) exhibits considerable differences and resembles far more closely that of *brevipus* sp. nov., while the pleon differs from the adult in the dorsal carination.

CYCLASPIS SPILOTES Hale.

Cyclaspis spilotes Hale, 1928, p. 36, fig. 5-6.

This species was known previously from a single male, 11 mm. in length and taken in South Australia. It proves, however, to be not uncommon near Rottnest Island, Western Australia, where a large series was secured at five localities by J. Clarke and R. Kenny in November, 1945.

Most of the Western Australian specimens are males, which differ from the type in being of smaller size (7 mm. to 8 mm. in length), and in the absence of defined dorso-lateral carinae on the pleon; in the type these ridges represent the upper edges of lateral tumidities of the first six abdominal somites, swellings which are rounded above in the Western Australian material. The pitting of the carapace is variable and in some examples the pits are larger than in others; the distinctive oblique lateral carina of the carapace is easily discernible. As in the

South Australian example the peduncle of the uropod is about one-fifth as long again as the exopod and bears an inner fringe of long setae with short plumes and a second series, in posterior half, of shorter, slender serrate spines; the exopod is a trifle longer than the endopod and is furnished with a row of six to ten stout spines on inner margin (usually tending towards the higher number) and two or three terminal "spines," one of which is long and conspicuous (fig. 10, sp.); the endopod has the distal end acute but unarmed and bears on the inner margin about half a dozen slender serrate spines, followed by a row of eleven, or thereabouts, of stouter and shorter spines; the distal fifth of length is unarmed.

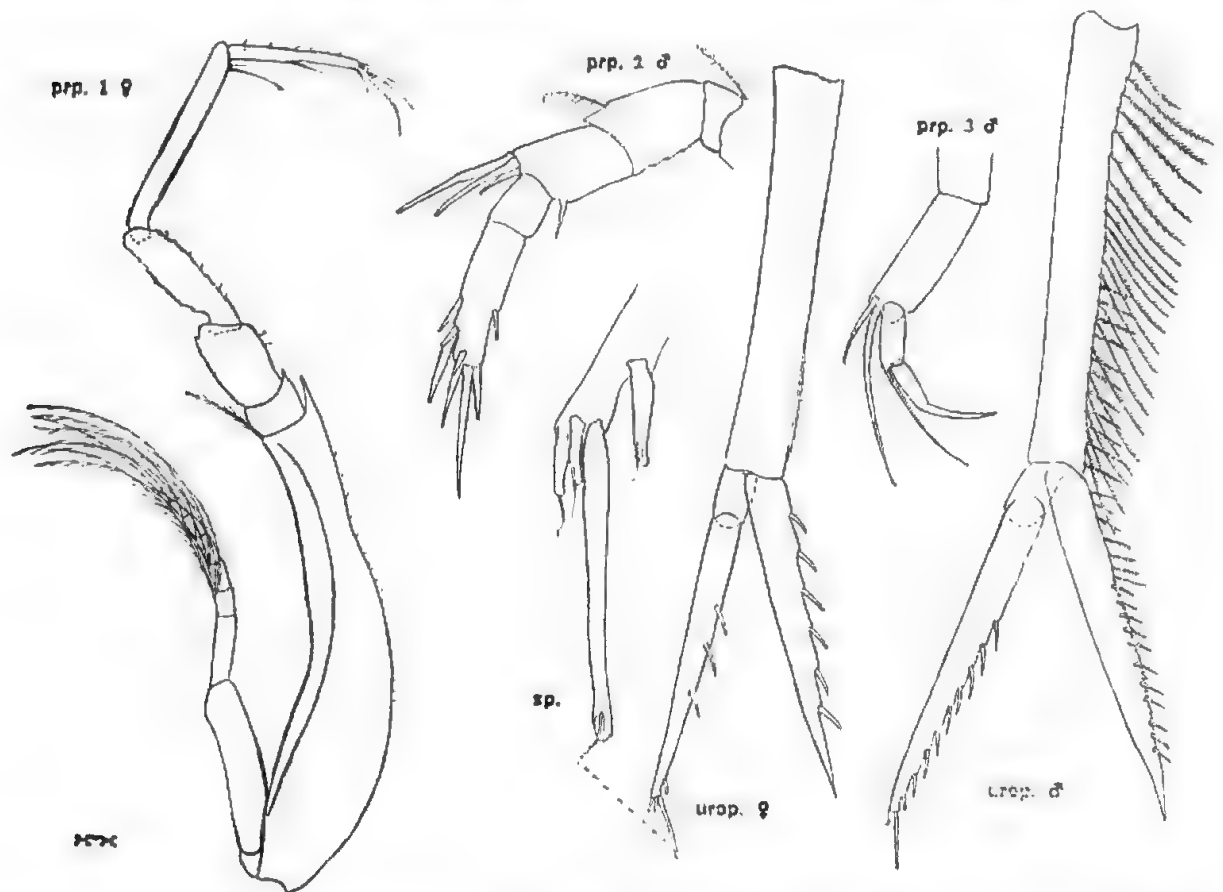


Fig. 10. *Cycloaspis spilotes*, ovigerous female and adult male; prp. 1, first peraeopod ($\times 47$); prp. 2 and 3, distal joints of second and third peraeopods ($\times 80$); urop., uropod ($\times 47$); sp., distal spines of exopod, $\times 252$).

Adult female. Amongst the Western material are several females, 6 mm. to 7 mm. in length, all of which have the integument soft and scarcely or not calcified. These have the marsupium fully developed; in some cases the brood-pouch is empty and the yellow ovaries contain large eggs, in others there are ova in the marsupium.

The basis of the first peraeopod is relatively shorter than in the male, being

not as long as the rest of the limb; it has an acute apical inner process, reaching forwards beyond middle of length of the ischium which has a similar but shorter distal tooth; the propodus is two-thirds as long again as dactylus, which is almost as long as carpus and has one of its terminal setae conspicuously stouter than the others. The remaining peraeopods are as in the male, the last three pairs having two distal carpal setae, the longer stout, more than twice as long as the other and like the propodal seta reaching to level of tip of dactylus. The latter is long for the genus, being about twice as long as propodus, and its distal half is marked off as a strong claw (fig. 10, prp. 3).

In the uropod the peduncle is about one-fifth as long again as the exopod, but lacks setae on inner margin which is finely serrate in distal third; the exopod is subequal in length to the endopod but has fewer inner spines than in the male, usually three only being present; the terminal spines of this ramus are as in the male; the endopod has no slender spines near proximal end, but the greater part of the length of inner margin is occupied by a series of half a dozen stout spines (fig. 10, urop.); the distal one-fourth of the length of the ramus is unarmed and its apex is simple and acute.

Salient features of the species are the oblique curved carina on the side of the carapace, the character of the uropods and the unusually well-armed distal joints of the second peraeopod (see fig. 10, prp. 2).

CYCLASPIS MOLLIS Hale.

Cyclaspis mollis Hale, 1944, p. 78, fig. 7-8.

Adult male. Integument thin but calcified and brittle.

Carapace plump, relatively conspicuously wider than in members of the *levis* group; it is two-sevenths of the total length of the animal, is less than twice as long as deep and is a little wider than deep; seen from the side the dorsum is only slightly arched from rear to base of ocular lobe and displays some minute irregularities because of pitting of the low, rounded, and not at all sharply defined median longitudinal carina of the back. Ocular lobe, as usual, larger than in female; it is as wide as long, tumid in lateral view and bears nine lenses, three of which are much larger than the others (fig. 11, c.pace.); it has a barely perceptible constriction at base and two of the large lenses extend for about half their diameter behind the lobe. Pseudorostral lobes meeting in front for a distance equal to approximately one-fourth of length of eye-lobe. Antennal notch widely open; antennal angle prominent and subacute.

Exposed pedigerous somites together little more than half as long as carapace; second (first free) somite with dorsum, as viewed from side, sloping obliquely backwards; its anterior pleural portion slightly overlaps the carapace and on the

back there is a distinct median carina; each of the third to fifth somites is transversely carinate at the posterior margin, the narrow strip of strongly calcified integument merging into the subtriangular lateral portion; the upper part of each of these lateral areas is slightly elevated; the anterior pleural portion of the third somite overlaps the second, while the fourth overlaps both third and fifth on the sides; the fifth somite has a median longitudinal carina on the back.

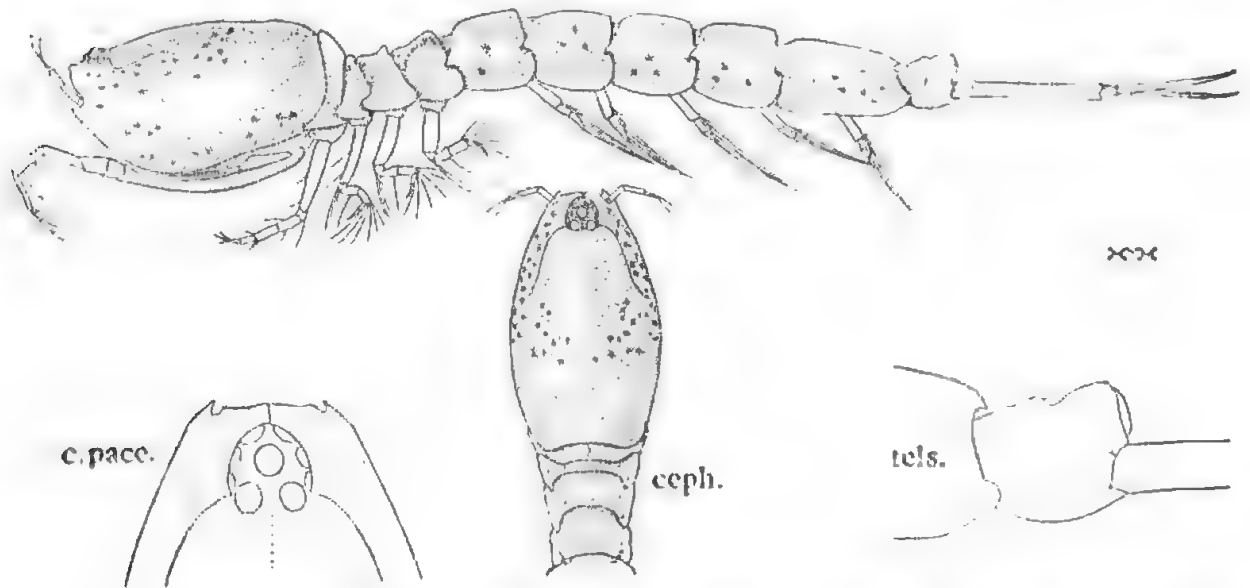


Fig. 11. *Cycloaspis mollis*, adult male; lateral view and (ceph.) cephalothorax from above ($\times 14$; c.pace., anterior portion of carapace from above ($\times 32$); tels., telsonic somite ($\times 32$).

Pleon more than one-fourth as long again as cephalothorax (only about one-twelfth as long again in female) and with the lateral articular pegs strong and subtriangular; there is a clear-cut median dorsal carina on somites one to five and on the fifth this is produced at posterior margin as an acute point (fig. 11, tels.); each of these somites is swollen fore and aft on the sides; the fifth is fully half as long again as the fourth (which is equal in length to each of the preceding somites) and is twice as long as the telsonic somite; the last-named is strongly notched dorsally at middle of length.

Mandible with many spines (about fifteen) in the long row (fig. 12, mand.).

First antenna rather long for the genus, with proportions of joints much as in female; the first segment of peduncle is subequal in length to second and third combined, and the third is only a little longer than second; flagellum two-jointed, the proximal segment more than twice as long as the small distal one.

First peraeopod with basis nearly one-fourth as long again as combined lengths of remaining joints; otherwise as in female. Second to fifth peraeopods as in female.

Peduncle of uropod more than twice as long as telsonic somite and distinctly longer than the slender ramī; on the inner edge it bears for the whole length a series of plumose setae and in distal third a second series of slender serrate spines; the exopod of this appendage is barely longer than endopod and is furnished with half a dozen plumose setae which, as in the female, are confined to the proximal fourth of length of inner margin of second joint; inner edge of endopod with

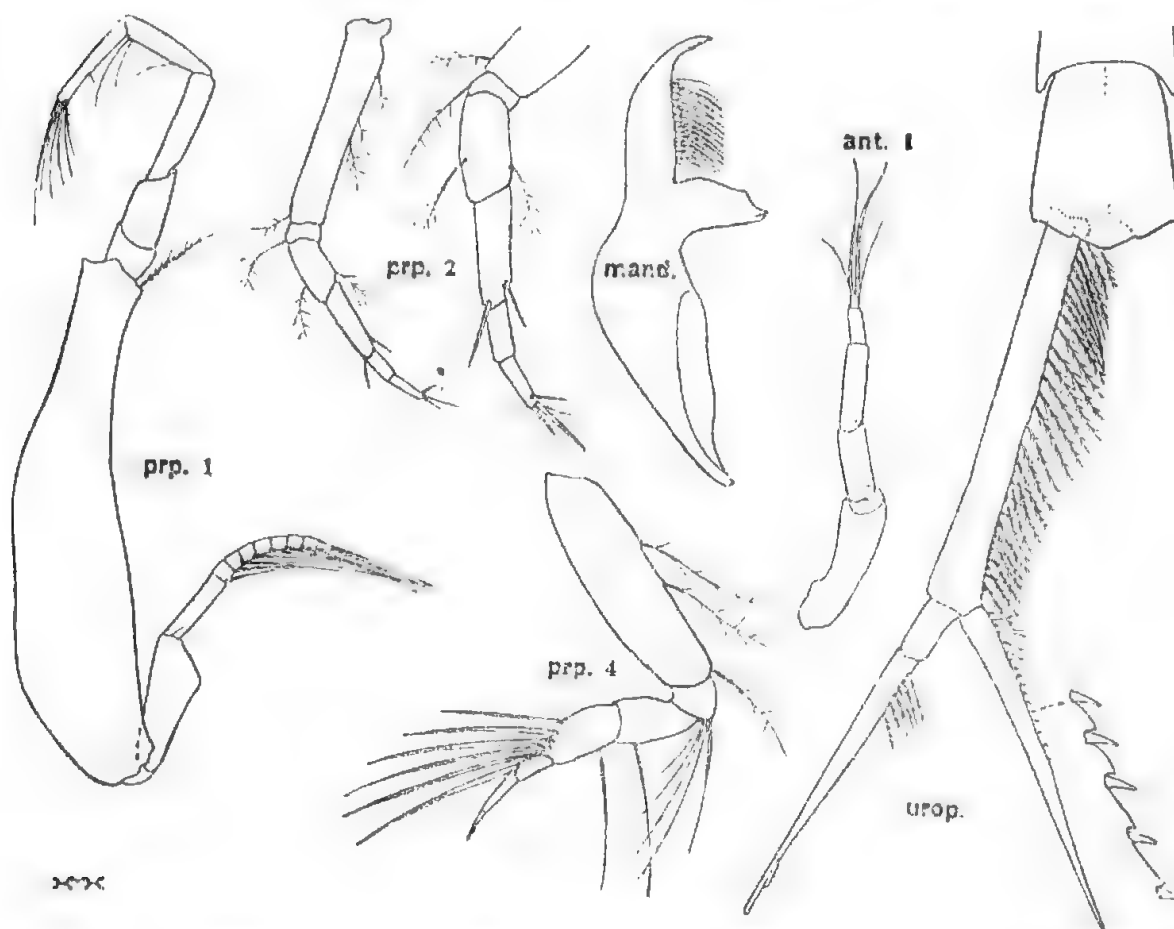


Fig. 12. *Cyclaspis mollis*, adult male; ant. 1, first antenna ($\times 62$); prp. 1, first pereopod ($\times 38$); prp. 2, second pereopod ($\times 38$; distal joints, $\times 62$); prp. 4, fourth pereopod ($\times 62$); urop., telsonic somite and uropod ($\times 38$).

half a dozen very slender serrate spines near proximal end followed by a series of a dozen or thereabouts of tiny spines, leaving the distal half of ramus unarmed; these minute spines, while a trifle larger than those of the female, are similarly inset (cf. fig. 12, urop., and Hale, 1944, fig. 8, G).

Colour white, with small brown chromatophores as shown.

Length 6.5 mm. to 6.75 mm.

Loc. Western Australia: Esperance Bay (A. G. Nicholls, January, 1946); Garden Island, Careening Bay (A. G. Nicholls, November, 1946).

Several males and females with developing marsupium were found amongst submarine light hauls of material made by Dr. Nicholls at the above localities in lat. 32·8° S. and 33·50° S. The species was previously known only from the adult female, taken on the Pacific coast of Australia, in lat. 34° S. The type ovigerous female, like the specimens described above, is well over 6 mm. in length. Examples from Moreton Bay, Queensland, collected by Mr. I. S. R. Munro, are much smaller, an egg-bearing female being only 2·5 mm. long.

Apart from characters given in a general key previously published (Hale, 1944, p. 71), *mollis* has several features enabling it to be easily separated from other species which have well-developed eyes, a plump body and the pseudorostral lobes meeting for an appreciable distance in front of the ocular lobe. The telsonic somite, for instance, is relatively shorter than is usual in the genus, while the first antennae have the second peduncular joint almost as long as the third. Of the related forms, only in *lucida* Hale are the fossorial setae of the posterior peraeopods similarly well developed; in both species there are five on the distal portion of the carpus and the longest, like the propodal seta, extend well beyond the tip of the slender dactylus; in *lucida*, however, the peduncle of the uropod is relatively much longer and the exopod of that appendage bears a terminal mucro.

CYCLASPIS FULGIDA Hale.

Cyclaspis fulgida Hale, 1944, p. 80, fig. 9-10.

Adult male. Integument thin, calcified and brittle. Carapace almost as plump as in *mollis*; it is more than two-seventh of total length of animal; seen from the side the dorsal edge is slightly less arched than in the female. The pseudorostral lobes meet in front of the eye-lobe but for a distance appreciably less than in *mollis*. Antennal notch and tooth as in male of *mollis*.

Exposed pedigerous somites together not much more than half as long as carapace; first free, or second, somite with pleural parts slightly overlapping carapace anteriorly, and with dorsum, as seen from the side, sloping steeply back from the subacute apex.

Pleon one-fourth as long again as cephalothorax (only one-tenth as long again in female) and with articular pegs rather feeble.

Flagellum of second antenna reaching to distal end of the long peduncle of uropod.

First peraeopod with carpus reaching to antennal tooth; basis only one-eighth as long again as combined lengths of remaining joints, and with inner angle, etc., as in female; proportions of distal joints as in female.

Second peraeopod with basis subequal in length to rest of limb, otherwise as in female.

Fossorial legs with setae short, none reaching beyond end of dactylus; there are only two carpal setae, one stout and almost as long as propodus and dactylus together, the other slender and only half as long; propodal seta very stout, a little shorter than dactylus.

Uropods long, the peduncle twice as long as telsonic somite, and a little longer than the subequal tapering rami, both of which have simple apices; proximal two-thirds of inner margin of endopod armed with spines, three or four slender ones near base, followed by fifteen to eighteen short spines.

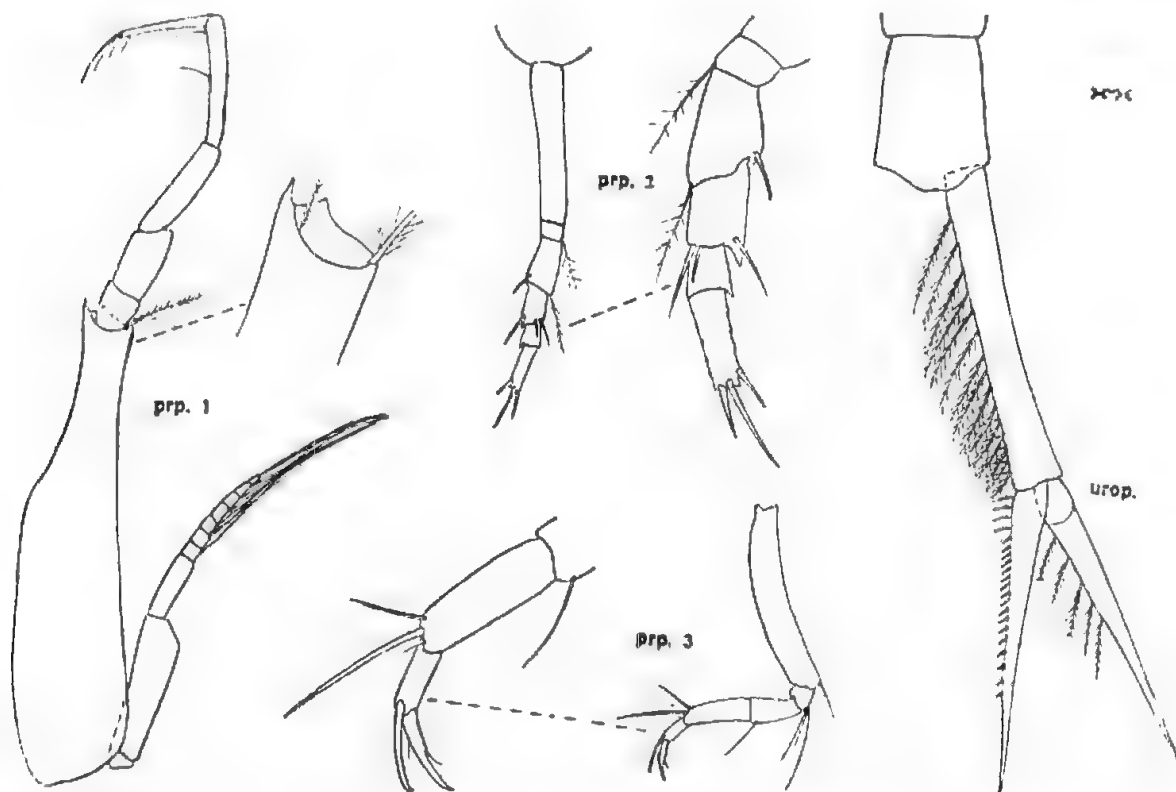


Fig. 13. *Cyclopsis fulgida*, adult male; prp. 1, first peracopod ($\times 44$; distal end of basis, $\times 88$); prp. 2-3, second and third peracopods ($\times 44$; distal joints, $\times 88$); urop., telsonic somite and uropod ($\times 44$).

Colour white.

Length 5 mm. to 5.5 mm.

Loc. Western Australia: Garden Island, Careening Bay (A. G. Nicholls, November, 1946). Three males were taken at the same times as the males of *mollis* recorded herein. They are readily separated at a glance by the setal armature of the fossorial limbs.

A couple of ovigerous females, tow-netted by Mr. I. S. R. Munro in Moreton Bay, Queensland, are only 2 mm. and 2.13 mm. in length; otherwise they differ only in trifling details from the 5.75 mm. type ovigerous female from Cronulla,

New South Wales. The rami of the uropods are slightly longer than the peduncle and the longest of the distal dactylar spines is longer than the dactylus itself.

Some species of Cumacea vary in size in different environments; apparently less often do they vary thus in the same situation, for series of adults of a species taken at one place and at the same time are generally approximately equal in size; the factors, possibly many, controlling these differences as yet remain unknown.

CYCLASPIS GLOBOSA Hale.

Cyclaspis globosa Hale, 1944, p. 99, fig. 25-26.

A subadult female, 5 mm. in length, was tow-netted at the surface 40-50 miles offshore in the neighbourhood of Lacedpede Bay, South Australia (K. Sheard, lat. 36° 35' S.; long. 138° 50' E.; 4 a.m., March, 1939, "Warreen" Station 98, depth at this spot 40 fathoms). The species was known previously only from off New South Wales.

CYCLASPIS CANA Hale.

Cyclaspis cana Hale, 1944, p. 132, fig. 51-52.

A series of males has now been secured near the type locality. The tubercles of the carapace vary very slightly in degree of prominence but two antero-lateral ones and two postero-lateral mark the corners of the "*exsculpta* group" lateral quadrangle; although there is no distinct depressed area on the sides, there may be exceedingly faint indications of an anterior transverse carina and an infero-lateral ridge.

Part of the first peraeopod is missing in the type. In this limb the basis is somewhat longer than remaining joints together, and the propodus is a little longer than merus, which slightly exceeds the dactylus in length; the edges of the joints are serrate, the teeth of the outer edge of merus and carpus, though not large, being more conspicuous than those elsewhere.

CYCLASPIS EXSCULPTA Sars.

Cyclaspis exsculpta Sars, 1887, p. 20, pl. i, fig. 24-26; Calman, 1905, pp. 3-4, and 1907, p. 6; Zimmer, 1921, pp. 7-9; Hale, 1944, p. 73.

The above references all discuss the only example previously referred to this species, the type female, which lacks the pleon and terminal segments of the first peraeopods. More than a score of males taken not very far from the type locality of *exsculpta* are here referred to that species because, allowing for the extreme sexual dimorphism which occurs in the adults of some members of the

genus (Hale, 1944, p. 114), they agree with *exsculpta* in differing from the other forms belonging to this section in having longitudinal ridges running forward from a distinct anterior transverse carina to the front of the carapace.

Adult male. Integument highly calcified, with a coarse reticulate surface patterning, which in the more strongly indurated specimens is reduced to a deep pitting rather than a distinctly honeycomb-like sculpture.

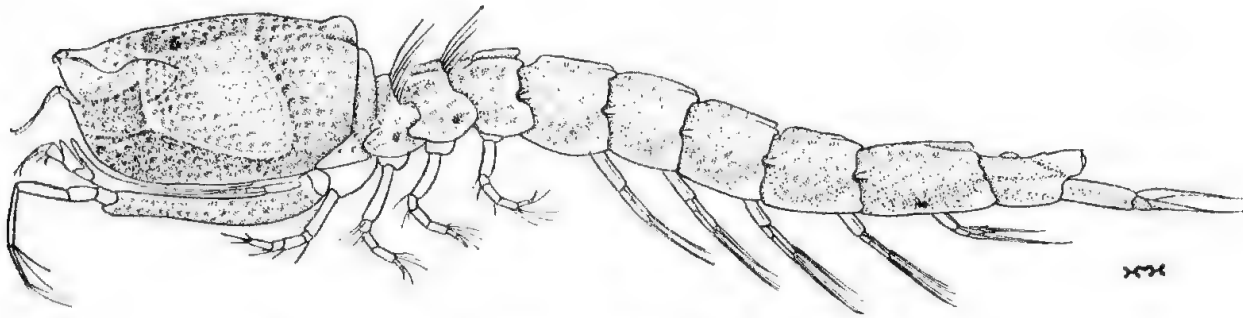


Fig. 14. *Cycloaspis exsculpta*, lateral view of adult male ($\times 14$).

Carapace three-tenths of total length of animal, not quite twice as long as deep and width across antero-lateral tubercles not much greater than depth; median dorsal carina almost smooth (faintly pitted) wide and extending from ocular lobe to posterior margin, where it is elevated to form a distinct tumidity; anterior, posterior, dorso-lateral and infero-lateral ridges well defined, although not greatly elevated as in female described by Sars; a ridge runs forward to antennal notch from the low upper antero-lateral tubercle and another from the lower front corner of the lateral quadrangle to front margin of carapace; while these carinae are well marked, the edges of the coarse reticulations form other irregular horizontal ridges anteriorly with certain lighting; that portion of the anterior transverse carina situate below the upper of the frontal horizontal ridges is sharp-edged, and projects slightly forwards; the posterior transverse ridge is not broken on the back, but completely meets the median carina; at the rear of the carapace there is a short obscure dorso-lateral ridge on each side of median carina, terminating at posterior margin but not (or very slightly in a few examples) projecting beyond this margin as in the female described by Sars, or in the female of *supersculpta* of Zimmer; the lower part of carapace is rather sharply inflexed below the lower of the antero-lateral and the infero-lateral ridges. Pseudorostral lobes as in *tribulis*, etc., not produced beyond the narrow ocular lobe, which bears seven distinct corneal lenses. Antennal notch narrow and rather deep; antennal tooth subacute.

First pedigerous somite concealed, second to fourth together barely more than half as long as carapace; second somite not at all elevated dorsally, tumid fore and

aft and with pleural parts overlapping carapace anteriorly; third somite dorsally no longer than second, with pleural parts overlapping second in front; fourth somite (like fifth) longer dorsally than second and third combined, with pleural parts overlapping third in front and fifth posteriorly, and with a dorso-lateral carina on each side; fifth with a median dorsal ridge and a pair of dorso-lateral carinae, projecting to form three small tubercles at posterior margin.

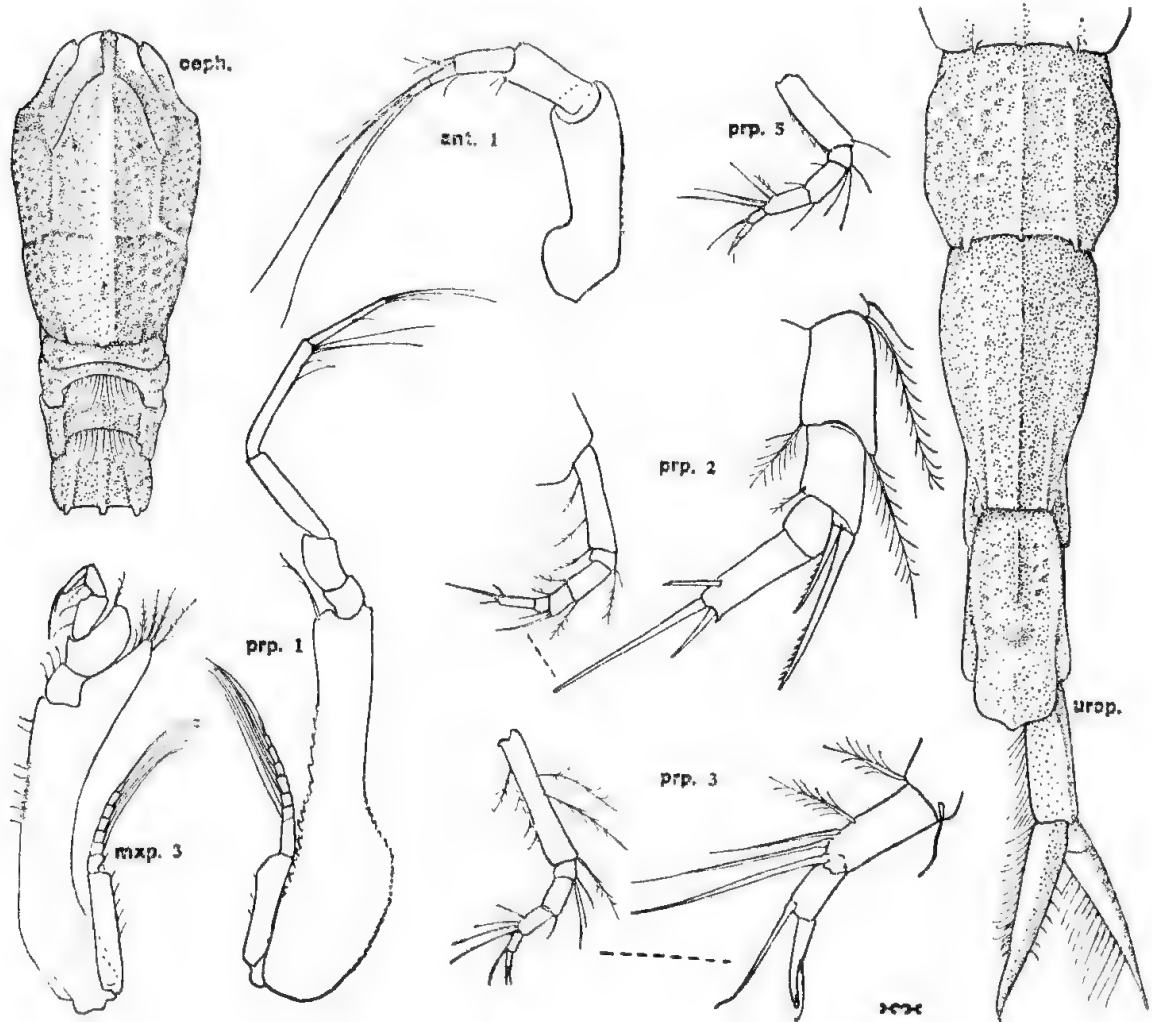


Fig. 15. *Cyclaspis exsculpta*, adult male; ceph., cephalothorax from above ($\times 14$); ant. 1, first antenna ($\times 76$); mxp. and prp., third maxilliped and peracopods ($\times 27$; distal joints of second and third legs, $\times 76$); urop., uropod with fourth, fifth and telsonic somites of pleon ($\times 27$).

First to fifth pleon somites together as long as cephalothorax, each with a low dorso-lateral carina on each side and a feeble median dorsal ridge; on somites one to four the carinae project beyond posterior margins as three tubercles, as distinct on the first as on the last pedigerous somite, less marked in the second to fourth; such projections are not present on the fifth which, however, has the

dorso-lateral carinae more elevated in posterior third than are those of the other somites; the dorsal width of fifth somite is little less than that of fourth anteriorly where it is swollen but it tapers to the rear, where it is only one-third as wide as long; telsonic somite with a feeble dorso-lateral carina on each side and with a sharp elevated median dorsal ridge in anterior half; there is a median dorsal tubercle on the groove marking the fusion between telson and sixth somite, and the telsonic part bears an obsolete median dorsal carina.

First joint of peduncle of first antenna more than half as long again as combined lengths of second and third joints, and second half as long again as third; main flagellum two-jointed, not quite as long as last peduncular segment; accessory lash small, unisegmentate. Second antennal flagellum reaching well beyond end of pleon, sometimes to distal end of rami of uropods.

Third maxilliped with basis not quite two and one-fourth times as long as rest of limb; otherwise much as in male of *tribulis*.

First peraeopod long, when extended with carpus reaching beyond level of end of pseudorostrum; basis subequal in length to rest of limb; propodus one-fifth as long again as merus and dactylus less than two-thirds as long as propodus.

Second peraeopod with basis shorter than rest of limb; distal joints and armature as in allied members of group.

Third to fifth peraeopods also are characteristic of *exsculpta* group.

Peduncle of uropod subquadrate in section, barely two-thirds as long as telsonic somite, two-thirds as long as the equal rami and furnished with a series of plumose setae on inner face; endopod with outer edge jaggedly serrate and with about eight spines and a few smaller but stout spines at second third of length of inner margin, preceded by a double row of "serrate" setae, shorter than those of peduncle, or than the spaced plumose setae on inner edge of exopod.

Colour greyish white.

Length 8 mm. or a little less.

Loc. Queensland: N. Palm Island (I. S. R. Munro, "Reliance" Station, submarine light, 7-9 p.m., October, 1941).

Sars' type was taken "September 8, 1874, at Flinders Passage, 7 fathoms." The locality referred to is just off Cape York, Queensland, and separates Horn Island from Tuesday Islets and Wednesday Island (lat. 10° 35' S.). There is also a Flinders Passage in the Great Barrier Reef a little to the east of the Palm Islands (lat. 18° 75' S.) where the males now recorded were taken.

The peduncle of the uropod in these Queensland males is slightly shorter in relation to the telsonic somite than it is in *candida*, *tribulis* or *usitata*. In this respect these examples approach more nearly to *supersculpta* Zimmer, the sub-adult type female of which is described as having the uropod as a whole not much

longer than the telsonic somite and with the rami twice as long as peduncle (Zimmer, 1921, p. 9, fig. 11). *C. supersculpta*, as mentioned by Zimmer, otherwise shows close affinities with *exsculpta*; it has, for instance, a short dorso-lateral ridge on each side of the median ridge at the hinder end of carapace (similar but longer ridges occur in the otherwise very distinct *persculpta* Calman). Accepting the reference of the above described males to *exsculpta*, then the only noteworthy feature separating *supersculpta* from Sars' species is the absence of defined ridges extending from the anterior transverse carina to the front of the carapace.

One doubt remains regarding the identification of the males from the Palm Islands; as noted, in these the posterior transverse carina joins the median ridge without trace of interruption. The subadult female of *exsculpta* has the hinder transverse crest "divided in the middle line by a distinct notch," in the female of *supersculpta* this carina is interrupted at the middle. In the male of *candida* the posterior ridge fades out on the middle of the back but is in any part very faint and difficult to trace.

The variation which may occur in the sculpture of the carapace of these highly indurated species of *Cyclaspis* is as yet not fully known (Zimmer, 1921, p. 9); it is certain that it alters during growth and may become sexually modified (Hale, 1944, p. 114) and that apparently there may be local variants—see *candida* herein and Hale, 1944, p. 115, fig. 36, A and F.

CYCLASPIS SHEARDI Hale.

Cyclaspis sheardi Hale, 1944, p. 86, fig. 15–16.

The species was described from the adult male only. A single egg-bearing female, from Whalers Bay, Kangaroo Island, South Australia, and taken with many further males by submarine light, is now available. There is no very decided sexual dimorphism in regard to the carapace, as there is in the adults of some members of the *exsculpta* group, but the following comparative details are noted.

Ovigerous female. Carapace deeper and wider than in male and with dorsal edge as seen from the side very slightly more arched; its depth is somewhat more than greatest width and two-thirds of length, which is little more than one-third of total length of animal; a sharp median dorsal ridge runs from apex of ocular lobe to posterior margin and immediately on each side of frontal lobe a faint horizontal carina extends back from anterior margin of pseudorostral lobes, fading out below end of frontal lobe (this ill-defined anterior dorso-lateral fold is present in the male also); in front of branchial regions a V-shaped group of small tubercles diverge; the crassate upper margin of each posterior pit is slightly angular, and the lower edge is bordered by a short horizontal ridge. Pseudo-

rostral lobes meeting in front of ocular lobe to form a very short pseudorostrum. Antennal notch narrowly V-shaped, not so widely open as in male, and antennal angle more acute.

First pedigerous somite exposed on sides but almost concealed on mid-line of dorsum; second not fitting closely against carapace dorsally as in male, but there separated by an interspace, narrowly V-shaped, as seen from the side; although five somites are exposed they are together relatively shorter than in male, being only half as long as carapace.

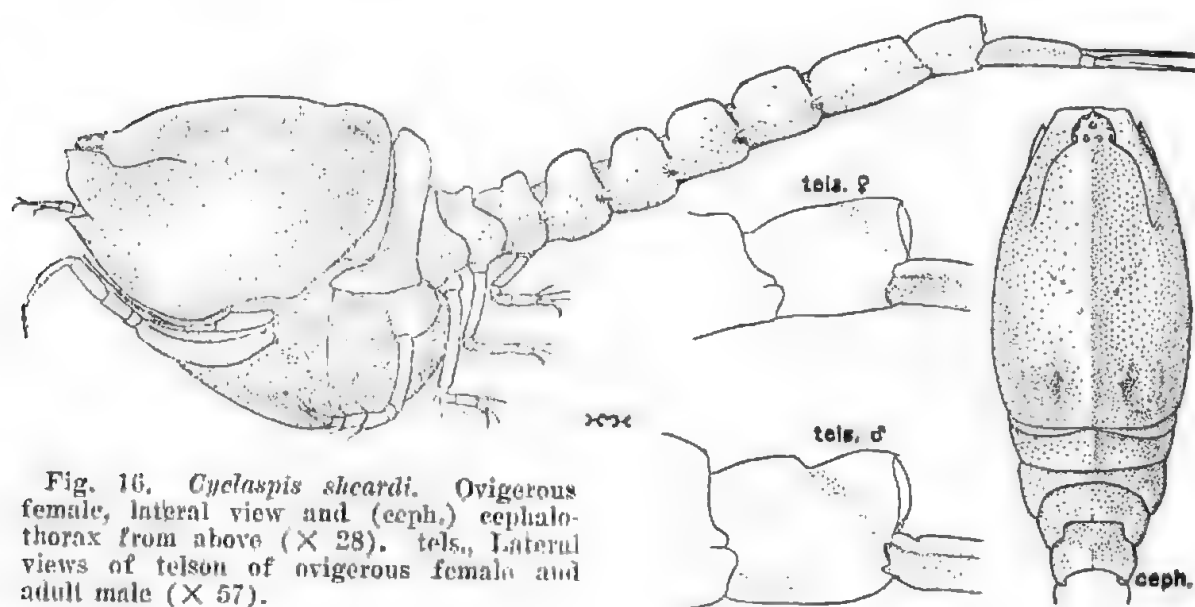


Fig. 16. *Cyclaspis sheardi*. Ovigerous female, lateral view and (ceph.) cephalothorax from above ($\times 28$). tels., Lateral views of telson of ovigerous female and adult male ($\times 57$).

Pleon much more slender than in male, and not longer than cephalothorax; telsonic somite with median dorsal ridge of anterior half less elevated and with telsonic portion not so distinctly marked off (fig. 15, cf. tels. ♂ and ♀).

First peraeopod short, the carpus not reaching to level of antennal angle; basis equal in length to remaining joints together. Remaining peraeopods much as in male.

Peduncle of uropod barely longer than the subequal rami, its inner margin feebly serrate in distal half; inner margin of exopod serrate and with plumose setae, that of endopod more coarsely serrate and with small inset spines.

Colour as in male (stellate spots not shown in fig. 15).

Length 3.6 mm.; ova in greatest diameter, 0.23 mm.

C. sheardi has a wide distribution, occurring off Tasmania, southern Australia and on the eastern coast as far north as lat. 34° S., while some of the material now in hand from Western Australia was taken off the Mary Anne Islands, etc., at

approximately lat. 21° S. and from Garden Island (lat. 32·8° S.). The female described is the only mature example of this sex so far taken.

Two allied species, *rudis* and *brevipes* spp. nov., are described below.

CYCLASPIS RUDIS sp. nov.

Adult male. Integument strongly calcified. Surface of carapace closely studded with flattened, forwardly directed granules.

Carapace less than one-third of total length of animal, slightly depressed and fully three-fourths as long again as deep; the greatest width occurs in anterior third, but is there barely wider than at middle of length, the sides as seen from above being evenly curved, with no prominences; there is, however, a marked

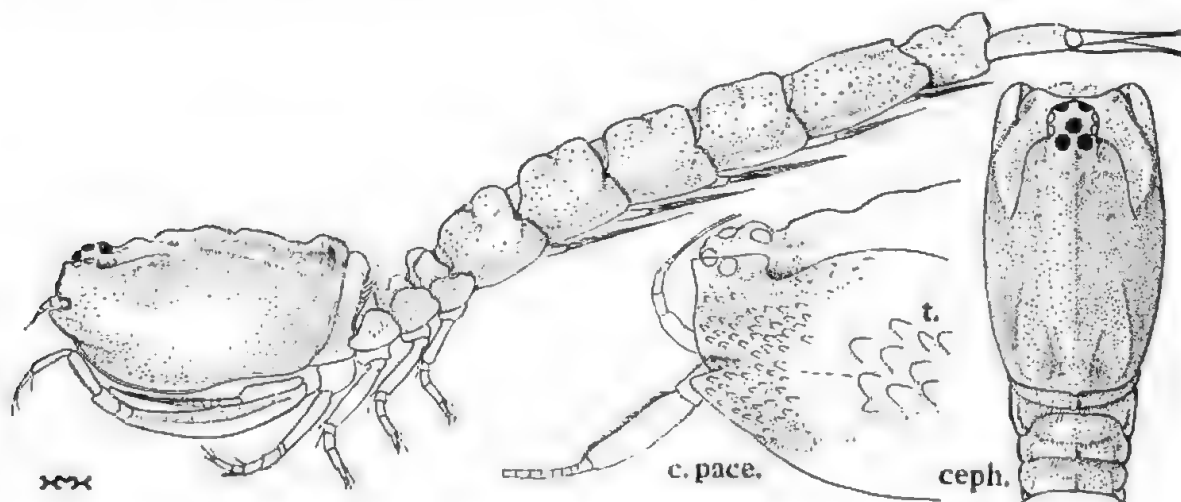


Fig. 17. *Cyclaspis rudis*, type male; lateral view and (ceph.) cephalothorax from above ($\times 21$); c.pace., anterior portion of carapace ($\times 47$; t., tubercles of carapace, $\times 100$).

tumidity on each side of the frontal lobe, and the area inferior to the antennal angle curves prominently outwards; viewed from the side the dorsal profile is irregular owing to a series of elevations of a well-defined median carina, the last prominence being situate at the posterior end; on each side, and below the suture of the frontal lobe, there is a clear cut carina (margining above the aforementioned antero-lateral swelling), and in posterior half of carapace a ridge extends on each side from rear margin to the pits so often present on hinder portion of frontal lobe; between each of these posterior dorso-lateral ridges and the median carina there is a large pit at hinder edge and above this depression a ridge runs forward from the median posterior prominence for a short distance; a very distinct short carina extends back from antennal angle. Pseudorostrum widely truncate, both as seen from above and from the side, the lobes meeting in front

of ocular lobe to form a short but distinct pseudorostrum. Antennal notch widely V-shaped; antennal angle prominent and subacute. Ocular lobe large about as wide as long and with nine distinct corneal lenses, the median five black, the others pale; two of the largest extend beyond hinder end of eye-lobe.

Four pedigerous somites exposed, together only about half as long as carapace; the second leg-bearing somite is fused with the carapace and is rounded dorsally,

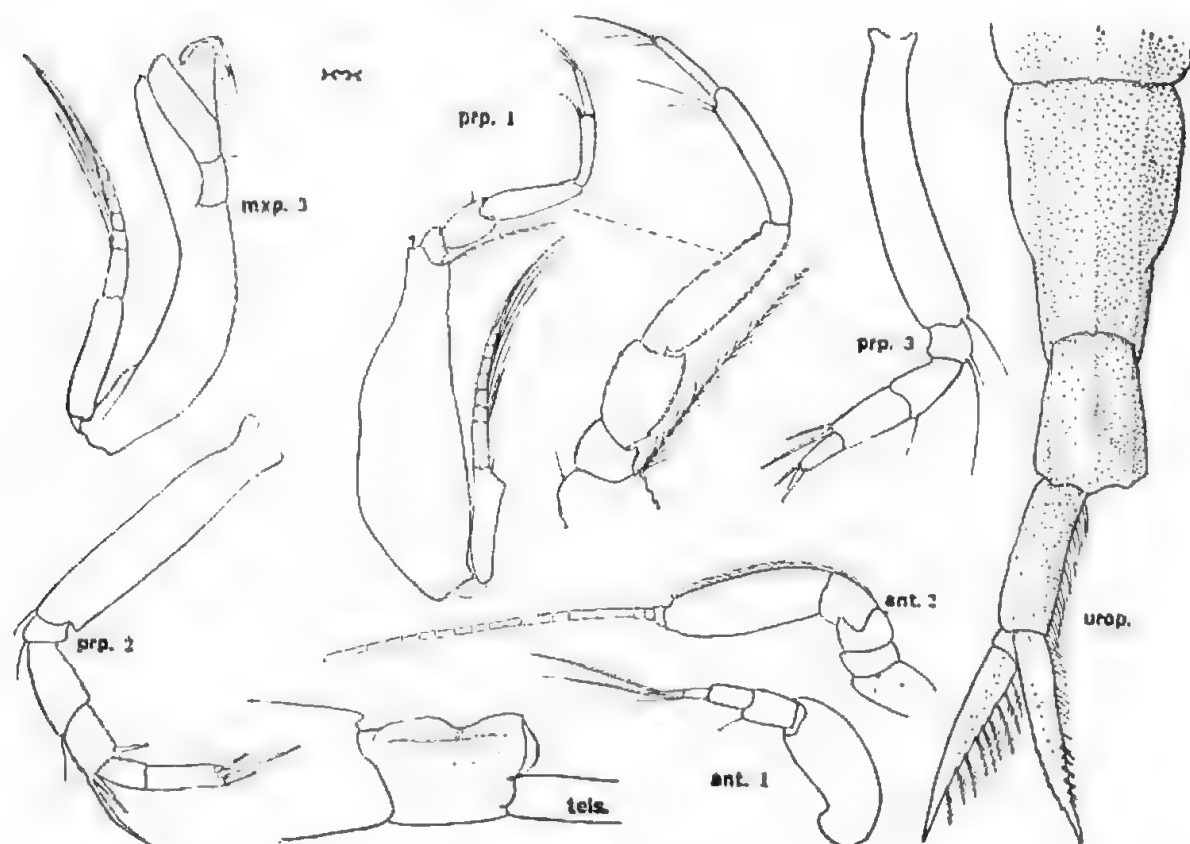


Fig. 18. *Cyelaspis rudis*, type male; ant. 1, first antenna ($\times 76$); ant. 2, second antenna ($\times 50$); mxp. 3 and prp. 1, third maxilliped and first pereopod ($\times 40$; distal joints of first leg, $\times 76$); urop., uropod with fifth pleon and telsonic somites ($\times 40$); tels., telsonic somite from the side ($\times 40$).

but not produced to level of posterior hump of carapace; marginal setae are present on second and fourth somites; second, fourth and fifth with a median dorsal longitudinal carina, projecting posteriorly as a small tubercle; third to fifth with the upper edges of the subtriangular lateral edges elevated and fourth and fifth with a dorso-lateral carina on each side.

Pleon massive, one-third as long again as cephalothorax; the first to fourth somites are tumid fore and aft on the sides and each has a distinct narrow, median dorsal carina and a pair of feeble dorso-lateral ridges, all projecting at posterior margins of somites as insignificant tubercles; the fifth somite tapers to the rear

and is fully half as long again as telsonic somite, is half as long again as greatest width and has a median dorsal carina and well-defined dorso-lateral carinae on each side in posterior half of length; the telsonic somite is about two-thirds as wide as long, has a sharp median ridge on anterior half, a deep incision marking off telsonic part and a dorso-lateral ridge on each side; its hinder margin is sinuate, but medianly is scarcely at all produced.

First joint of peduncle of first antenna as long as remaining peduncular joints and flagellum together; second peduncular segment subequal in length to third; flagellum two-jointed. Second antenna with flagellum reaching a little beyond end of telsonic somite; fifth peduncular joint equal to combined lengths of segments one to four.

Basis of third maxilliped two-thirds as long again as remaining joints together and with outer distal lobe very large, extending to well beyond anterior end of articulation of merus and carpus; outer lobe of merus reaching to level of anterior end of carpus.

First pereopod, when extended, with carpus attaining level of antennal angle; basis nearly one-fourth as long again as rest of limb; carpus three-fourths as long again as merus, fully one-fourth as long again as propodus and twice as long as dactylus.

Dactylus of second pereopod shorter than merus, longer than carpus and three-fourths as long again as propodus; its longest distal spine is as long as the joint and its other two much shorter spines are subequal in length; the basis is almost as long as rest of limb.

Basis in third pereopods longer than rest of limb, about equal to this in fourth and shorter in fifth; carpus in all posterior limbs a little longer than merus and nearly half as long again as propodus; the longer of the two carpal setae, and the propodal seta, do not reach beyond tip of dactylus.

Peduncle of uropod with a dorso-lateral carina; it is equal in length to telsonic somite, little more than two-thirds as long as exopod, and with a fringe of setae on inner edge; endopod barely shorter than exopod, with setae on anterior half, and a few spines on posterior half, of inner margin; exopod with a few inner plumose setae.

Ground colour pale yellow, with anterior and inferior edges of carapace, lower edges of pedigerous and pleon somites, and all carinae, margined with white. Carapace, in addition, with closely placed large spots of dark brown (not shown in figure).

Length 5 mm.

Loc. Western Australia: Off Garden Island (type loc., G. P. Whitley, submarine light, 6.50 p.m.–7.10 p.m., July, 1945); King Sound (G. P. Whitley, ex cutter "Isobel," submarine light, 7 p.m.–7.20 p.m., September, 1945, surface

temperature 21.6° C.); Mary Anne Island, 3½ fathoms (G. P. Whitley, ex cutter "Isobel," submarine light, 7.15 p.m.—7.45 p.m., November, 1945, surface temperature 26° C.). Type in South Australian Museum, Reg. No. C. 2844.

A dozen adults, all males, were secured; the localities range from 17° S. to 32.8° S.

As in *brevipes* sp. nov. the plan of sculpture of the carapace is essentially as in the related *sheardi*, which possesses similar posterior dorsal pits, and antero-lateral tumidities while it has traces of longitudinal dorso-lateral carinae. The proportions of the uropods alone provide for the ready separation of the three species, but other obvious differences are noted in the descriptions.

CYCLASPIS BREVIPES sp. nov.

Adult male. Integument calcified and brittle. Surface of carapace smooth except for very fine reticulate patterning.

Carapace robust, not much more than half as long again as deep; it is less than one-third of total length of animal and is a little narrower than greatest depth; viewed from above the sides are evenly curved for the greater part of their length but anteriorly the areas inferior to the antennal angle are flared outwards; in lateral view the dorsum of the carapace is very slightly wavy and there is no

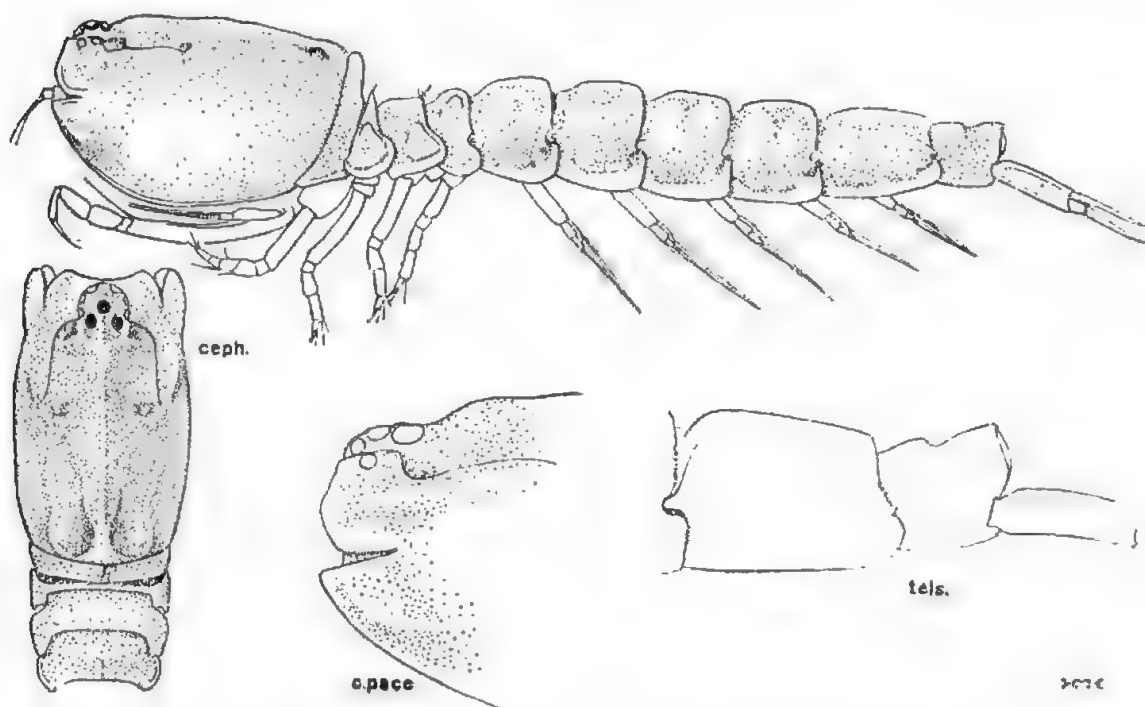


Fig. 19. *Cyclaspis brevipes*, type male; lateral view and (ceph.) cephalothorax from above ($\times 15$); c.pace., anterior portion of carapace ($\times 28$); tels., fifth pleon and telsonic somites with peduncle of uropod ($\times 25$).

marked elevation at the rear, although the strong median carina is here swollen; there is a pair of posterior dorsal pits as in *rudis* and carinae which are disposed much as in that species; on the frontal lobe there is a transverse ridge (feebly developed in *rudis*) immediately behind the ocular lobe. Pseudorostrum broadly truncate, the lobes meeting for a short distance in front of ocular lobe, which is much as in *rudis*. Antennal notch broadly V-shaped but extending inwards as a closed slit.

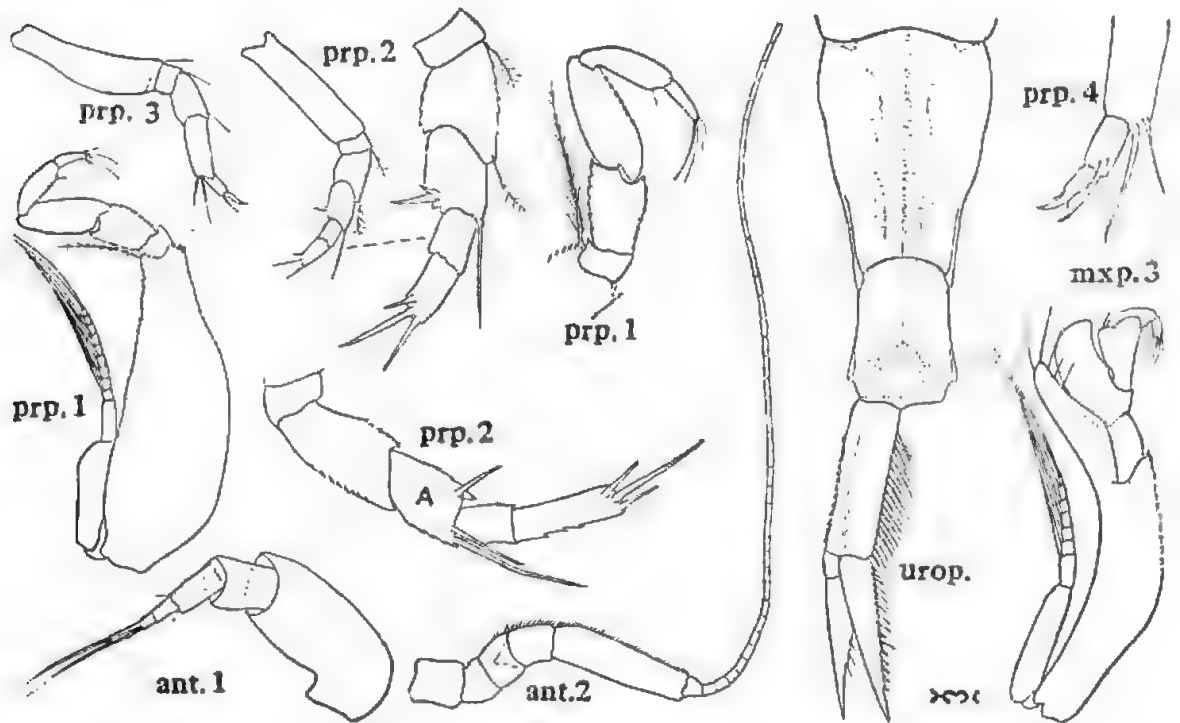


Fig. 20. *Cyelasps brevipes*, adult male; ant. 1, first antenna ($\times 105$); ant. 2, second antenna, distal portion of flagellum omitted ($\times 47$); mxp. 3, third maxilliped ($\times 47$); prp. 1, first peracopod ($\times 47$; distal joints, $\times 66$); prp. 2-4, second to fourth peracopods ($\times 47$; distal joints of second and fourth, $\times 105$); urop., uropod with fifth pleon and telsonic somites ($\times 47$). A, Distal joints of second peracopod of adult male of *C. rudis* for comparison.

The four exposed pedigerous somites are together more than half as long as carapace; second and fourth each with a short median dorsal carina; other somites smooth on dorsum.

Pleon robust, only one-fifth as long again as cephalothorax; first to fourth somites each with a strong median carina on back, but no dorso-lateral ridges; fifth somite tapering to the rear, half as long again as telsonic somite, more than half as long again as greatest width and with a strong median dorsal carina. Telsonic somite broadest at the rear (where it is three-fourths as wide as long) with a median ridge on proximal half of back, a distinct dorsal notch but no dorso-lateral carinae.

Antennae and maxilliped much as in *rudis* (see fig. 19 mxp. and ant.).

First pereopod short and stout, the carpus of the extended limb not reaching to antennal angle; basis more than one-fourth as long again as rest of limb and with greatest breadth equal to one-third of its length; carpus less than three-fourths as long as merus, nearly half as long again as propodus and two and three-fourths times as long as dactylus.

Dactylus of second pereopod little more than half as long as merus, shorter than carpus and barely longer than propodus; its longest distal spine is longer than the joint and the other two distal spines are unequal in length; the basis is as long as remaining joints together.

Basis of third pereopod equal in length to rest of limb, that of fourth and fifth pairs shorter; carpus of posterior legs longer than merus and twice as long as propodus; setae as in *rudis*.

Peduncle of uropod with dorso-lateral carina and with plumose setae on inner margin; it is equal in length to the telsonic somite and to the exopod, which has half a dozen inner plumose setae; endopod equal in length to exopod, with ten slender spines in proximal half and six shorter and stronger spines in distal half.

Colour dark purplish brown, the front and inferior portions of carapace, and lower parts of pedigerous and pleon somites, margined with pale yellow.

Length 4 mm.

Loc. Western Australia: Shark Bay, west of Cape Peron, 3 fathoms (G. P. Whitley, ex cutter "Isobel," submarine light, 8 p.m.—8.20 p.m., August, 1945, surface temperature 18.55° C.; off Onslow, Airlic Island, 3 fathoms, on rock, coral and sand bottom (type loc., G. P. Whitley, ex cutter "Isobel," submarine light, 7.40 p.m.—8 p.m., September, 1945, surface temperature 21.6° C. Type in South Australian Museum, Reg. No. C. 3014.

A ridge corresponding to the anterior transverse carina of the *exculpta* group, runs across the frontal lobe just behind the eye-lobe and connects the antero-lateral tumidities. This carina, more feebly developed, is present in *rudis* also. The whole sculpture plan is as in *rudis*, but *brevipes* differs in having the carapace relatively deeper and (apart from the ridges and pits) smooth instead of granulate, while its dorsum is not markedly irregular; further, all the pleon somites are relatively shorter, the first and second pereopods are shorter, with the joints of different proportions, and the uropods are distinctly shorter, with the rami equal in length to the peduncle.

As noted under *rudis*, this species is allied to *shardi*. *C. simula* Hale (1944, p. 130, fig. 49-50) also has some features in common with *brevipes* and, similarly, has the distal joints of the first pereopods short; the last feature may be due to immaturity, *simula* being known only from the young male. In the latter

the peduncle of the uropod is one-fourth as long again as telsonic somite and one-third as long again as the rami, and it may be assumed that the whole appendage is relatively longer in the adult male.

CYCLASPIS MJOBERGI Zimmer.

Cyclaspis mjobergi Zimmer, 1921, p. 11, fig. 14-16; Hale, 1944, p. 88, fig. 17-18 (male).

? *Cyclaspis usitata* Hale, 1932, p. 549, fig. 1, and 1944, p. 122, fig. 43 (female).

There is now an opportunity to compare with the material recorded below as *candida* South Australian males previously referred to *mjobergi* as well as a series of males secured at three localities in Shark Bay, Western Australia (G. P. Whitley, September-November, 1945) and at Garden Island, Western Australia (A. G. Nicholls, November, 1946); the western males here referred to *mjobergi* are of the same size as those from the south, being thus considerably smaller than Zimmer's types, which were taken off Cape Jaubert, north-western Australia.

There is no doubt that *candida* and *mjobergi* are very closely allied—the male of the last-named differing only (1) as pointed out by Zimmer in having the dactylus of the first leg longer in relation to the propodus of that limb (see fig. 20, A and B, prp. 1); (2) in having the ridges so generally characteristic of the *exsculpta* group obsolete. Nevertheless, its place in this group is undoubted, although in my key (Hale, 1944, p. 71) the absence of ridges arbitrarily throws it with the *levis* group (see also Hale, 1944, pp. 64 and 66).

Although the *exsculpta* type of ridging is absent there is, in some of the examples from South Australia, some slight suggestion of the sculpture. This consists, in the first place of the tumidity, previously noted, below the frontal lobe and occupying the site of the large antero-lateral tubercles where typically developed; secondly, the dorsum of the carapace is not always so completely smoothly arched as in the specimen figured previously, and there may be present a minute median dorsal tubercle, in the same position as that formed by the first transverse ridge of some other species of the *exsculpta* group (fig. 20, A). The surface pitting as described by Zimmer seems to be merely a modification of the coarse honeycomb pattern; this surface sculpturing varies in the males of *exsculpta* where a thickening of the walls of the reticulations may greatly reduce the size of the enclosed area.

The males from Shark Bay, Western Australia, have the dactylus of the first pereopod three-fourths to four-fifths as long as the propodus of that limb and the peduncle of the uropod while a little longer than in the South Australian examples is nevertheless slightly shorter than the rami; it seems probable that the tips of the latter were damaged in the types.

Males from Garden Island, 9mm. in length, have the peduncle of the uropod shorter than the rami. Although the proportions of the terminal joints of the first peraeopods are as in the southern examples, they are relatively much more elongate, the combined lengths of these joints (ischium to dactylus) being

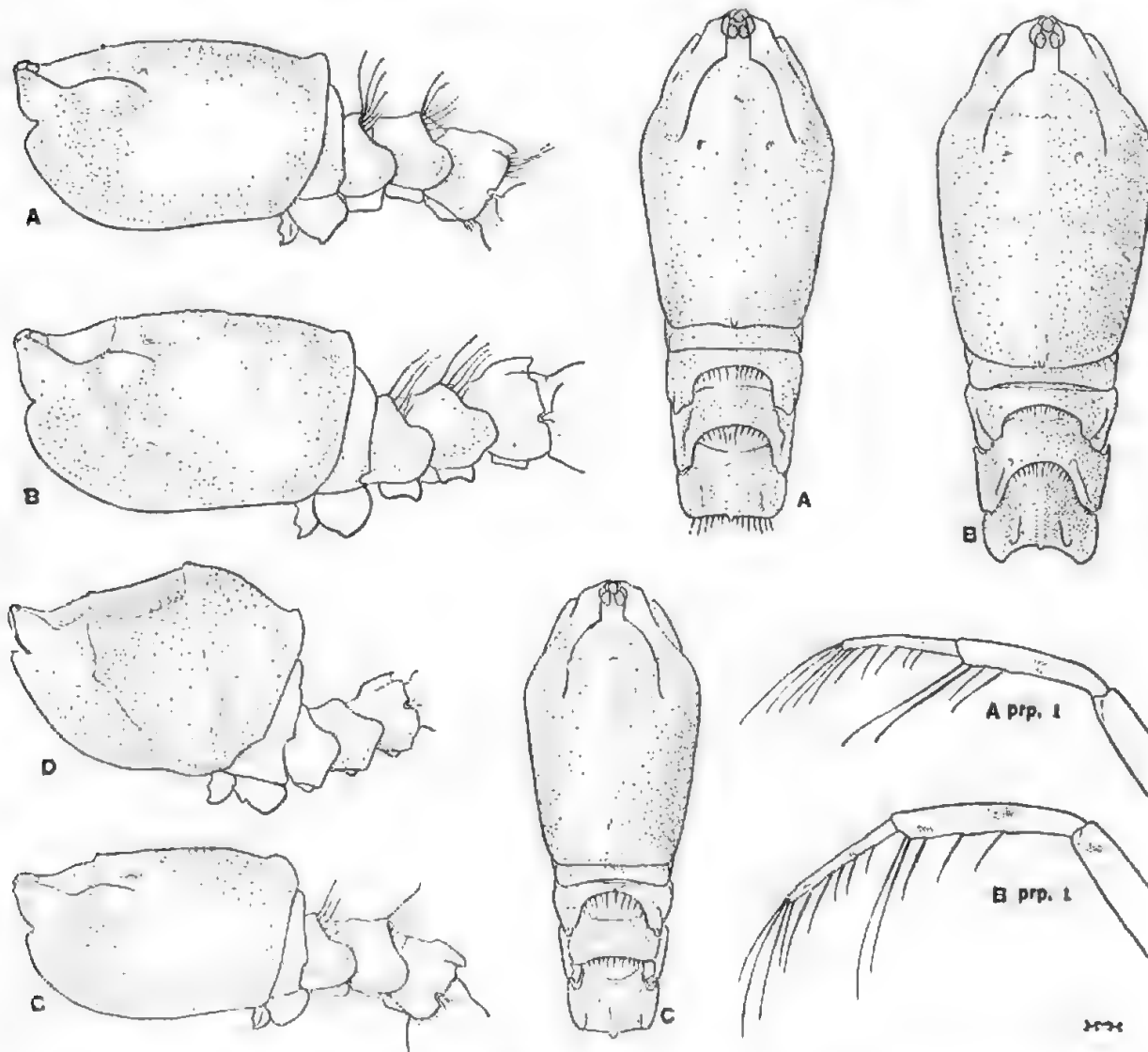


Fig. 21. A, *Cyclops mjobergi*, adult male from South Australia; lateral and dorsal views of cephalothorax ($\times 16$); prp. I, distal joints of first peraeopod ($\times 45$). B, *C. candida*, adult male from New South Wales; lateral and dorsal views of cephalothorax ($\times 16$); prp. I, distal joints of first peraeopod ($\times 45$). C, Lateral and dorsal views of cephalothorax of adult male of *C. candida* from Queensland ($\times 16$). D, Lateral view of cephalothorax of non-ovigerous female of *C. candida* from Queensland ($\times 16$).

equal to the length of the basis, whereas in South Australian specimens the last-named is half as long again in relation to the rest of the limb.

As mentioned below, under *candida*, ovigerous females described from South Australia as *usitata* differ from a very similar adult female taken in Shark Bay,

Western Australia, only in having the dactylus of the first pereopod a little longer in relation to the propodus, a difference found between the males of *candida* and *mjobergi*. Thus, if the two species are really separable it would appear that *usitata* is the female of *mjobergi*. Many adult males of the last-named species and a large number of ovigerous females of *usitata* were taken on the same night but in separate hauls at Brighton, South Australia, in October, 1941.

CYCLASPIS CANDIDA Zimmer.

Cyclaspis candida Zimmer, 1921, p. 9, fig. 12-13.

Adult male, New South Wales. A series of examples nearly 8 mm. in total length and taken from Cronulla (H. M. Hale and K. Sheard, submarine light, 8 feet on sand, January, 1944) are referred to this species. Although the size is considerably smaller than Zimmer's type male from North-Western Australia (12.6 mm.) they exhibit no significant character by which they can be separated. As stated in the original description the sculpture of the carapace is faint; the first transverse ridge is, however, distinct on the back and the posterior transverse carina is traceable on the dorsum (where it is interrupted medianly) and for a short distance on the sides of most examples (fig. 20, B).

Zimmer describes the peduncle of the uropod of the type as being almost as long as the rami; in the males now recorded it is fully two-thirds as long as the rami.

The dactylus of the first pereopod, as in the type, is two-thirds as long as the propodus.

Adult male, Queensland. A goodly number of males were found stranded at the water's edge in the Noosa River (an inlet of the sea) by Mr. I. S. R. Munro, June, 1944, and in September, 1945, the same collector secured by trawling in the same locality a single adult male and an immature male. These males are only 6.5 mm. in length, thus being still smaller than the New South Wales specimens and barely more than half as long as the type. The appendages are as in the other material except that the peduncle of the uropod is a trifle shorter in relation to the rami. In some examples, however, the sculpture of the carapace is still less apparent. The anterior transverse carina, with its tiny median dorsal projection, is fairly easily made out with careful lighting, but there is no trace of the second transverse carina (fig. 20, C) or at most the feeblest indications of such ridge.

Non-ovigerous female, Queensland. Stranded with the males just noted were a couple of subadult females of about the same size presumed to belong to the same species (fig. 20, D). These resemble the subadult female previously figured

from New South Wales (Hale, 1944, fig. 44) as *usitata*; incidentally, immature males from New South Wales and the aforementioned subadult Queensland male are about 7 mm. in length and have the form just as in these females, with the ridges of the carapace distinct but with the second pedigerous somite not at all elevated dorsally. In *tribulis* the sculpture of the carapace is strong in the female and young male but is partially obliterated in the adult male.

Adult male, Western Australia. A dozen males taken in Shark Bay (Broadhurst Bight, G. P. Whitley, November, 1945) are of the same size (8 mm.) as the aforementioned New South Wales males, which they otherwise closely resemble.

Ovigerous female, Western Australia. An ovigerous female, 6 mm. in length and taken with immature females and a young male in Shark Bay (Monkeymia, 2 fathoms, G. P. Whitley, November, 1945) is referred here; it is very close to the South Australian adult females previously described as *usitata* (Hale, 1932, p. 549, fig. 1, and 1944, p. 122, fig. 43), the only appreciable difference being that the dactylus of the first pereopod is a little shorter in relation to the propodus, being less than two-thirds as long as the latter instead of fully two-thirds as long as it.

REFERENCES CITED.

- Calman, W. T. (1904): "Report on the Cumacea collected by Prof. Herdman, at Ceylon, in 1902." *Ceylon Pearl Oyster Fish.* 1904, Supp. Rep., xii, pp. 159-180, pl. i-v.
- Calman, W. T. (1905): "The Cumacea of the Siboga Expedition." *Siboga Exped.*, Mon., xxvi, pp. 1-23, pl. i-ii, text fig. 1-4.
- Calman, W. T. (1907): "On New or Rare Crustacea of the Order Cumacea from the Collection of the Copenhagen Museum. Part I. The Families Bodotriidae, Vauntomponiidae, and Leneonidae." *Trans. Zool. Soc.*, xviii, pp. 1-58, pl. i-ix.
- Calman, W. T. (1917): *Brit. Antarc. ("Terro Nova") Exped.*, 1910. *Nat. Hist. Rep. Zool.*, iii, part iv, pp. 145-156, fig. 4-9.
- Hale, Herbert M. (1928): "Australian Cumacea." *Trans. Roy. Soc., S. Aust.*, lii, pp. 31-48, fig. 1-17.
- Hale, Herbert M. (1932): "A Cumacean New to South Australia." *Rec. S. Aust. Mus.*, iv, pp. 549-550, fig. 1.
- Hale, Herbert M. (1936): "Three New Cumacea from South Australia." *Rec. S. Aust. Mus.*, v, pp. 395-403, fig. 1-6.
- Hale, Herbert M. (1936a): "Cumacea from a South Australian Reef." *Rec. S. Aust. Mus.*, v, pp. 404-438, fig. 1-23.

- Hale, Herbert M. (1937) : "Further Notes on the Cumacea of South Australian Reefs." *Rec. S. Aust. Mus.*, vi, pp. 61-74, fig. 1-9.
- Hale, Herbert M. (1944) : "The Genus *Cyclaspis*." *Rec. S. Aust. Mus.*, viii, pp. 63-142, fig. 1-60.
- Hale, Herbert M. (1946) : "The Family Diastylidae, Part 2." *Rec. S. Aust. Mus.*, viii, pp. 357-444, fig. 1-60.
- Sars, G. O. (1887) : *Rep. Sci. Res. "Challenger,"* Zool. xix, part lv, "Report on the Cumacea," p. 1-73, pl. i-xi.
- Zimmer, Carl (1921) : Results of Dr. Mjoberg's Swedish Scientific Expedition to Australia, 1910-13, xxvi. *Cumaceen. Kongl. Svenska Vet.-Akad. Hand.*, lxi (No. 7), pp. 1-13, fig. 1-16.